# AN EDITORIAL ANNOUNCEMENT

LORD KELVIN, able scientist, once said: "When you can measure what you are speaking about and express it in numbers, you know something about it, and when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind. It may be the beginning of knowledge, but you have scarcely in your thought advanced to the stage of a science."

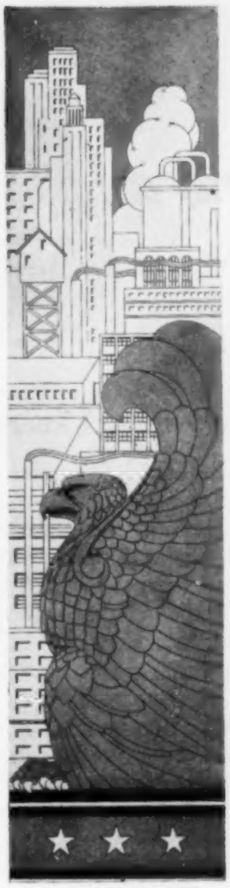
How far has chemical industry advanced toward a scientific statistical basis on which to plan its production and consumption of commodities? What economic data are still lacking if chemical industry is to interpret its true objectives and accomplishments to its own employees, to customers and consumer organizations? What are the factors with which the public can measure the benefits of chemical research, or the industry's contributions to health and safety—to mention but a few of its manifold services to mankind!

*Chem. & Met.* has long recognized the seriousness of these problems and year by year its Annual Review Numbers have made it increasingly possible for chemical industry to measure its transactions, quantitatively as well as qualitatively. But now there appears to be a need for an even greater service to the industries that make and use chemicals. A statistical fact-picture of the field, presented and interpreted in the light of modern economic and social trends, would serve many useful and timely purposes, alike for engineer and executive. To meet such a need a thorough-going study was commenced several months ago by the editors of *Chem. & Met.* and will culminate in the publication of a special supplement to the September, 1937, issue—a well-rounded reference and data book of "Facts and Figures of the American Chemical Industry."

This supplement will, in effect, constitute an interpretation of the present status and important trends in the chemical-producing and chemical-consuming industries. Raw material sources and requirements, employment factors, fuel and power consumption, contributions to public health and safety, research progress, price trends, containers and transportation, taxes, and even the balance-sheet considerations that determine profits, will be statistically presented and analyzed. The result will be an impartial, factual picture and not in any sense a theoretical or philosophical assembly of ideas and opinions.

That this project has been favorably received by all of the industrial leaders who have been consulted in its planning is indeed gratifying. That the executive committee of the largest and oldest trade association in the industry should find this proposal worthy of encouragement is ample promise of cooperation from important chemical companies in gathering and studying the pertinent mass of economic and technologic data. If, in addition, we may have the continued interest and support of all *Chem. & Met.* readers—whether engineers or executives, workers or salaried employees, raw material suppliers or consumers of finished products—it is certain that our combined efforts will greatly advance our common interest in increased knowledge and better understanding of chemical industry.

Sidney D. Kirkpatrick



## FACTS and FIGURES of the AMERICAN CHEMICAL INDUSTRY

# *From an* EDITORIAL VIEWPOINT

### THAT VICIOUS RISING SPIRAL

CHEMICALS so far have largely resisted the upward surge of prices but every day the threat becomes more imminent. With metals leading the advance, and prices for building materials, paint and pigments, paper and pulp, farm products, fuels and textiles, all rapidly rising, it is certain that higher labor and raw material costs will eventually catch up with profits in many process industries. What is to be done about it? To go along with the rest and raise prices indiscriminately merely adds impetus to the rising spiral of living costs and prices, without real gain for anyone concerned.

These spirals in the past have always ended in collapse through buyers' strikes or, oftener, through reckless speculation and inflation. At a time when all industry is frantically rushing to raise its prices, wouldn't it be a fine thing if chemical industry could stick by its guns — defending to the last, its belief in the gospel of the research laboratory: "More goods at lower prices?" That today is the greatest challenge ever put up to the chemical engineer and production executive. If by means of better technology and more efficient methods and equipment he can keep chemical industry from surrendering to the price-raiser, he will have done a great service not only to his company and his industry, but perhaps to the whole structure of American business.

### SOMETHING STARTED

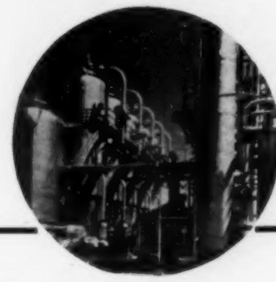
LIKE PRETTY FLOWERS that bloom in the Springtime, the annual Packaging Shows in New York have come and gone with only casual attention from chemical engineers and production men in process industries. But this year the American Management Association, through an organizing committee headed by Richard W. Lahey of American Cyanamid, introduced an entirely new note in the program. Under the rather contradictory title of "Bulk Packaging," an all-day session was attended by a hundred or more men who got down to the very practical problems of packing and shipping in such humble containers as bags and drums. "Design" to these men meant something more than an eye-appeal of pretty packages on the grocer's shelf. Rigid performance specifications, resistance to corrosion and contamination, safety in handling and shipment of dangerous commodities — these and other considerations outlined in detail on pages 207-210 of this issue were the subjects on which there was a frank exchange of knowledge and experience.

This first experiment in bringing together the men responsible for the packaging and shipping of a wide variety of industrial materials clearly demonstrated their common field of interest. All that is needed is an open forum and a program that calls forth and stimulates discussion and free exchange of ideas. Something long overdue was started in this Seventh Annual Packaging Conference and Exhibition of A.M.A. and unless we misread the signs, chemical engineers will have an increasing interest in any future plans to carry forward constructive programs of this sort.

### COOPERATIVE VS MANDATORY

AMONG the several measures on stream pollution now before the Congress, the Vinson Bill (HR.2711) seems best from most viewpoints. It recognizes the local responsibility and jurisdiction of the states and at the same time provides for full cooperation between industry and the federal and state governments. It is of a "cooperative" type as contrasted with the stringent "mandatory" means proposed in the Lonergan, Pfeifer and Spence bills. As approved by the Rivers and Harbors Committee of the House, the Vinson measure calls for the annual expenditure of $700,000 by the U. S. Public Health Service for studies of stream pollution, together with $300,000 for administrative costs. In addition, there is a provision for WPA allotments to cities and counties on a loan and grant basis. Estimates that as much as $40,000,000 annually might be used under this provision for stream pollution control are indeed startling, yet if wisely and adequately administered much good might be accomplished without serious loss to the federal government.

If the Vinson bill is enacted into law, and many Washington observers feel that this is quite likely, much will depend on the men responsible for its administration. It will benefit or harm industry, and likewise the public, depending on the proper exercise of its "in cooperation" clauses. Industries should not be rushed into the use of unsound waste-disposal processes nor cities forced to spend huge sums on sewage treatment plants without adequate knowledge and study of all the facts. Properly administered, the Vinson bill provides the machinery whereby a chemical engineer can



prove to industry and to the cities that the cleaning up of our water courses is profitable as well as essential to the public health.

**TOO MUCH OR TOO LITTLE**

IS THE SOUTH repeating the mistake that Canada made a few years ago when too many newsprint mills were constructed north of the St. Lawrence? Surely the kraft mills are rising along the Atlantic and Gulf Coasts at an almost unbelievable rate. The thirteen new mills are adding 1,350,000 tons to the annual output of the Southern mills, and this is twice the amount of kraft pulp annually imported into the United States (738,097 tons in 1936). What is to become of this apparent surplus? Will it bring ruin to the industry? Those chemical engineers who have made a study of the situation will tell you that while it is true that the output of only a few of the larger mills is sufficient to replace imported pulp, that other mills will be employed to replace high-cost producers in the North. They will also remind you that there is a steady increase in the per capita consumption of paper products, and that the greater strength and equal color of bleached sulphate make it preferable to sulphite pulp for a large number of purposes. Upon these conditions depends the future of the Southern kraft industry.

**GERMANY BOOMS U. S. TAR**

SHORTAGES of tar products in the United States, notably of naphthalene and tar acids, have originated in the difficulty of securing these and other commodities from the former German sources under the present Nazi restrictions on trade and money settlements. It was inevitable that American coal tar, of which there is an abundance, should be more fully utilized to supply the deficiencies caused by waning imports.

For a considerable number of years coke-oven operators and tar-products users in this country have been restive. They recognized potential new markets and new applications if an abundant supply at a suitable price could be arranged. It is too soon to tell whether the German-induced difficulties were not all that was needed to stimulate the complete domestication of the coal-tar industry.

Apparently that effect can be hoped for. In any event, substantial new construction of tar-refining facilities has already been undertaken on the part of those who are financially capable of carrying this development through to successful operation. Consumers who formerly hesitated to use domestic tar products, because of uncertainties in supply, will shortly find no such excuse to interfere with complete American development.

It is even hinted by big manufacturers that they are ready to make toluol, benzol, and related organic "crudes" from other sources than normal oven tar. As that development is realized in economic operation, there promises to be not only real stimulus for the organic chemical industry, but also a possibility for more blended motor fuel containing benzol.

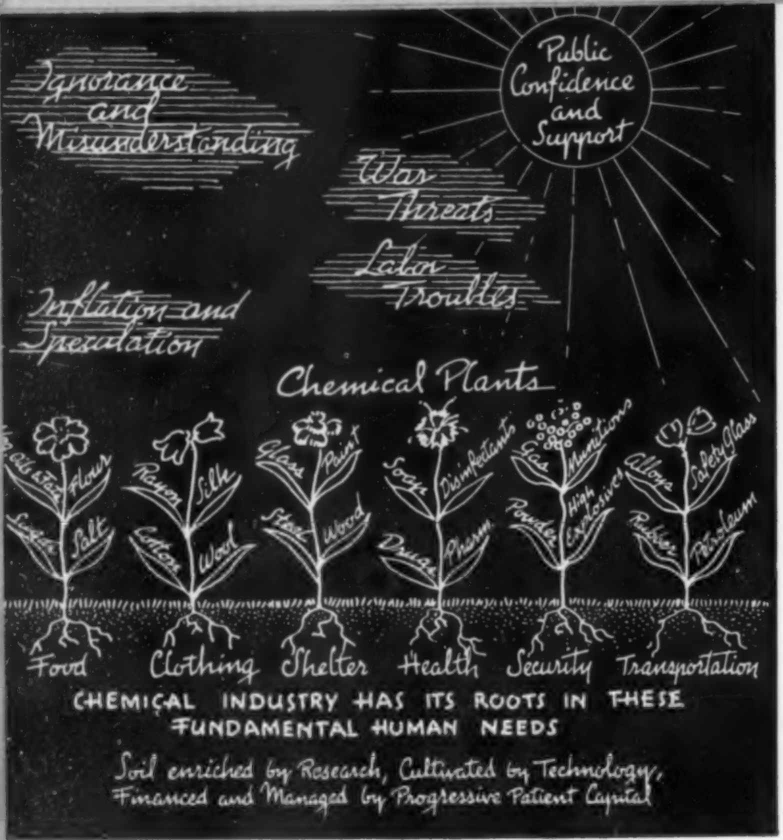
As a whole, these developments represent a sound trend in which producers and important users should cooperate. Long run benefits will accrue to both parties if initial contracts can be made with mutual interests entering into negotiations.

**FUME TROUBLES IN THE OFFING**

PROCESS INDUSTRIES should begin to worry again about "smoke farming." This worry is rightly inspired by recent ultra-zealous efforts on the part of certain agricultural specialists in Washington. They are advising the Department of State and the American members of the tribunal which is adjusting the Canadian-American problem of indemnity for smelter fumes from Trail, British Columbia. Unless some interruption to the present course of events can be arranged, the Trail settlements may establish a dangerous precedent for other industrial enterprises in the States, particularly the smelters.

At least one agricultural spokesman argues that any (even minute) quantities of sulphur are intolerably detrimental to crops. Such extreme view will probably not be officially accepted by the international tribunal, but it may have its influence on the opinion being built up. Furthermore, it provides a basis for smoke-farming claims elsewhere which probably would not otherwise arise.

Many real problems remain to be solved both in smelter dust and in sulphurous gas nuisances. Fair-minded officials recognize that important companies are aggressively working on these problems with a view to restricting the escape of gas and dust to an unavoidable minimum. But perhaps they are justified in believing that even more vigorous activity in this direction should be encouraged.




# Clouds on the CHEMICAL HORIZON?

### A plea for an industry program of public education

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*By S. D. KIRKPATRICK*
EDITOR OF CHEM. & MET.

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**Extracts from a John E. Sweet lecture entitled: "Behind the Scenes in the Greatest Show on Earth—Chemical Industry"—presented before the Technology Club and Affiliated Societies of Syracuse, N. Y., March 22, 1937.**

WITH new chemical plants blooming under the warm sunshine of the South and with bumper crops reported from the North, East and West, prospects are most encouraging. In fact, things look so promising that we might easily become over-optimistic—forgetting for the moment that the products of chemical industry, like those of the farm, depend upon many factors for their continued growth.

Chemical industry has its roots in the six fundamental human needs for food, shelter, clothing, health, security and transportation. Those roots must be firmly implanted in fertile soil, constantly renewed through research, efficiently cultivated by modern chemical engineering technology, wisely managed and ably financed by patient, progressive capital. But with all of these factors in its favor, the chemical plant will not grow without the sunshine of public confidence and support. Whatever cuts off those life-giving rays threatens the future of all of us.

Therefore, let us look carefully at the clouds that are beginning to appear on the chemical horizon. They may well be warnings of impending storms. Or they may soon be dispersed by the sun—with only a gentle, stimulating shower.

Largest cloud of all is "Ignorance and Misunderstanding." As a matter of fact it might well envelop all the others for certainly the threats of war or labor troubles arise from misunderstanding of purposes and objectives. But thinking now more of the man in the street, what does chemical industry mean to him? Does he think of chemical plants as deeply rooted in fundamental human needs? Or does he still believe we work in some mysterious atmosphere of fumes and flames, deadly poisons and dangerous explosives? Too often he does. He is still a victim of that blight handed down from the days of the alchemist and so frequently repeated by imaginative fiction writers and radio commentators.

Here is a case in point. Lowell Thomas, ordinarily a very sane and accurate fellow, who incidentally draws at least part of his pay from a process industry based on chemical engineering technology, wrote an article a few years ago in *Liberty* entitled "Following the Paths of Reckless Lives Through Fumes and Flames. Breath-taking Perils That Surround Those Who Labor With Gases and Chemicals and the Awful Penalties Paid for Mistakes." Graciously, he makes a hero, in the following words, of every man who works in a chemical plant: "There is surely something splendidly heroic about a man who works, day after day, in a place the very air of which is freighted with death—which may, for no predictable reason or because of some slight slip, destroy him without a split second's warning!"

Lowell tells some tall stories over the radio, but in this article he presented as the gospel truth a highly improbable yarn about the boss of a chemical plant who is instantly killed by a couple of drops of "an incredibly powerful and deadly poison gas" (sic) left on the back of his chair by a careless chemist. When I called Editor Oursler's attention to this libel of the good name of chemical industry, he published my letter with the official accident statistics showing that our plants are no more hazardous than those of other industries—that falls from ladders, broken

heads from flying monkey wrenches and smashed fingers and toes are vastly more serious sources of accident than "fumes and flames." Shortly thereafter a note came from Mr. Thomas explaining that he had employed a "digger-up" who must have drawn "the long bow"—that personally he preferred the truth to fiction and hoped no real damage was done.

Perhaps there was no real damage done, but it is at least conceivable that such an article might prove costly for chemical industry in stirring up labor troubles, increasing insurance rates and, most important of all in alienating public confidence.

Another evident but unfortunate case of misunderstanding and ignorance has occurred in the recent advertising of World Peaceways, Inc. A particularly flagrant example was the page which appeared in the November issues of *Scribner's* and certain other magazines of large circulation. It was entitled: "If he's lucky, a million men will die!"—and depicted a begoggled research chemist "working on a more deadly and inhuman poison gas." It warned you against "extremely clever appeals to your emotions" and "extremely ingenious propaganda." It carried with it the clear implication that we in the chemical profession are part of a ruthless handful intent on dragging the decent people of the world into a horrible chemical war.

When letters to World Peaceways, Inc. and to the editor of *Scribner's* failed to get responses, I wrote the editorial "Toward a More Secure Peace" that appeared on page 629 of the December *Chem. & Met.* In it I pointed out that chemical industry is opposed to war for selfish as well as humanitarian reasons—that our greatest advances and profits as well have come from contributions to health and comfort, rather than to death and destruction. I asked for an apology to the chemical profession.

What happened? Not a word came from World Peaceways, Inc. but about the middle of January literally dozens of letters and post-cards started arriving from all parts of the country. In them, chemists and chemical engineers were called all manner of names—such as "mercenary murderers" or "stool pigeons for munitions makers." Many of these letters were from small-town doctors and dentists, elderly men and women that would not ordinarily have access to *Chem. & Met.*

So I investigated and found that World Peaceways, Inc. had reprinted in the January "Peaceways Forum" some brief (and not entirely fair) excerpts from my editorial and cited as contradictory evidence several questionable statements by professional soldiers and sensational writers such as Beverly Nichols in his "Cry Havoc!" (1921). Then followed instructions to the members to write the editor of *Chem. & Met.* telling him what they thought of his editorial.

A great many did and in each case received a personal answer inclosing comments on the same editorial by President Karl Compton of Massachusetts Institute of Technology who is Chairman of the President's Advisory Committee on Science and Dean Frank C. Whitmore of Pennsylvania State College, who is President-Elect of the American Chemical Society. Instead of prolonging the argument, however, I suggested that wherever possible my critics should talk with some chemical engineer or chemical manufacturer of my acquaintance in his community—making sure I sent copies of the letters to all concerned. The results were most interesting and gratifying. Apparently there is nothing like a face-to-face talk to clear up misunderstandings.

Now as a final point I should like to cite another type of misinformation about chemical industry which also has a bearing on the labor situation. Last September our Washington office sent me a copy of a report on "Chemicals and Allied Products—an Analysis of Production, Wages and Employment, 1914–1933." This report was issued by the coordinator for industrial cooperation, Major George L. Berry. It had all of the appearance and earmarks of an official government document which, of course, it was.

The official statistics used were those of the United States Census Bureau, but these figures were cleverly distorted to give a wholly unfair indictment of chemical industry. For example, Major Berry's report shows "that chemical industry is the lowest of all industrial groups in the percentage of the value added by manufacture which is paid out in wages—19.2 per cent as compared with 36.2 per cent for all industry." No mention is made of the fact that chemical wages are considerably higher than the average, nor does the report show that because of heavy plant investment, rapid obsolescence and the need for technical supervision, that labor is a relatively less important element in chemical costs.

Perhaps without going any further with the discussion of the labor or the war clouds, I have cited sufficient evidence to prove my point—namely, that chemical industry today is facing a vitally important problem of public education. The companies that go to make up the industry must take the lead in a broad program of public relations. Furthermore, we as individual members of the chemical profession have a serious responsibility in connection with anything that affects unfavorably public confidence in and support of the American chemical industry.

Some chemical companies have followed a policy of silence for many years in the belief that it is a wise policy. Steady growth and increased earnings over the past period of development would seem to confirm the wisdom of such a course. Yet there often comes a time when a company's affairs are singled out for discussion or investigation. This is especially true in these days when all the trends are toward social and political control. Recent experience has shown that those who discuss and investigate are seldom sympathetic nor are they sticklers for accuracy or understatement. On the other hand, if a company tells its story to the public, not once but on every occasion of an important development, it will gradually become a part of the public consciousness and the company will thereby be less vulnerable to the exaggerations or falsities generated by its critics.

The same principle, it seems to me, applies equally well to an industry as to a company. If the public is correctly and constantly informed of what an industry is doing, its objectives as well as its accomplishments, a sympathetic interest is bound to be developed.

# TECHNOLOGY TRANSCENDS HERITAGE IN MODERN DISTILLERY PRACTICE

BEFORE PROHIBITION, whiskey-making was regarded more or less as some form of mysterious art. The methods of production and the yeast used were jealously guarded and handed down from father to son in the manner of a heritage. Use of poor quality grain, unsanitary handling at all stages of manufacture, and the use of crude and antiquated equipment gave the distiller a low yield of the desired higher alcohols, acids, aldehydes and furfural, and a large quantity of undesirable volatile fermentation products such as allyl alcohol, acrolein, butanol, butyric acid, and sulphur and nitrogen compounds. All of these were included in the whiskey as barreled, with the result that long periods of corrective aging were required in addition to the natural maturing.

Unfortunately for the industry and the public, repeal of the 18th Amendment saw most of the old distilleries put back into operation under the same type of management, using the same type of machinery, and employing the same methods of manufacture as had been used fifty years before. From a technical point of view, the industry was still operating as of the 19th century, and to add insult to injury, various distillers advertised that they were making the same kind of XX whiskey as grandpappy had in 1880.

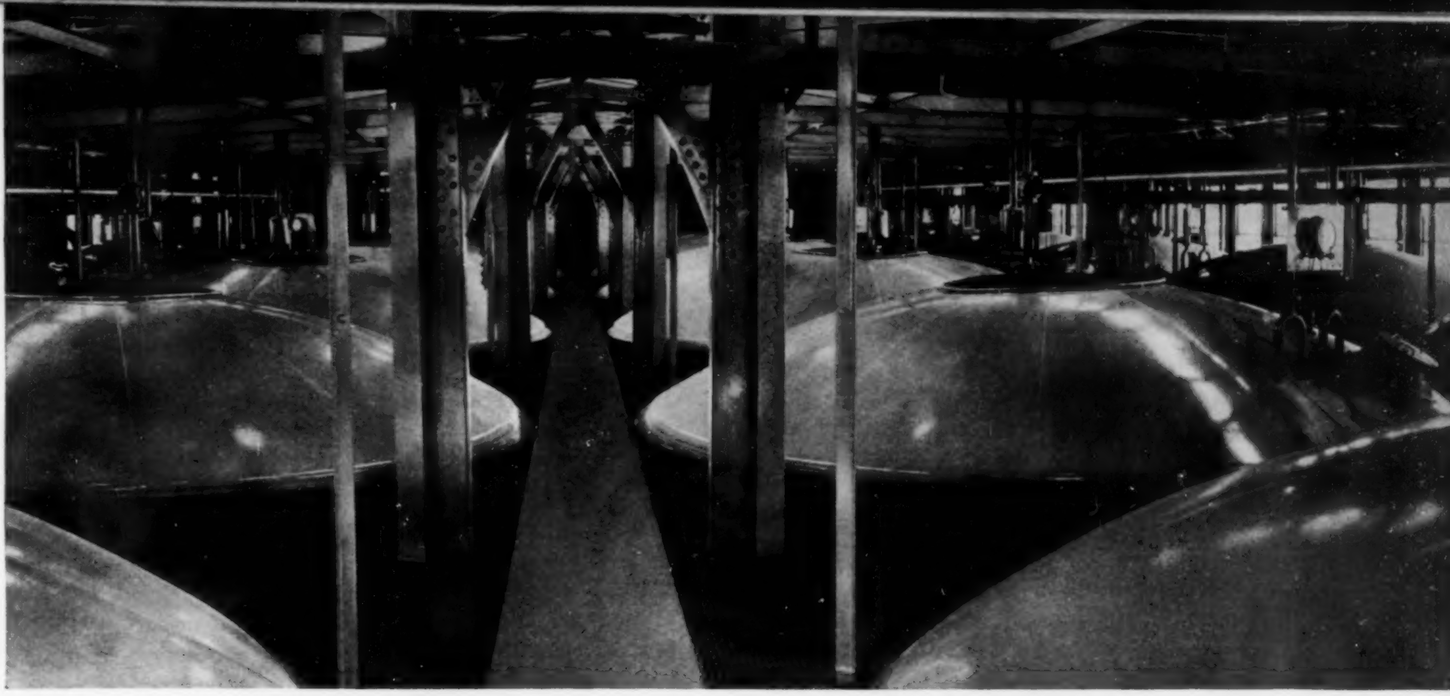
Fortunately, a few distillers built upon their previous experience in making whiskies, preserved all that was good and sound in fact, capitalized upon their years of experience, and most important of all, called upon modern methods of processing, handling, and controlling all operations. Mechanical, chemical, and biological control became a reality in these few distilleries. All variables in manufacturing were put under automatic control. Processing was conducted in a sanitary manner which produced a clean fermentation and hence a clean beer free of all undesirable constituents and containing the proper quantity of the desirable congeneric products.

The writers wish to present here some of the "old time" methods in contrast with the modern methods of production and control.

Presented under the title, "Advances in Modern Distillery Operations," at the Baltimore meeting of the American Institute of Chemical Engineers, Nov. 11, 1936.

## Grains

The grains most commonly used in distilling operations are corn and rye. Malted grains are used for converting the starches in the primary grains to sugars for fermentation. Because of their inherent suitable qualities, barley malts and rye malts are used in most cases. Despite minority denials, research and production data have proved that the manufacture of distilled spirits is no exception to the universal rule that "quality starts with the raw materials." In the "good old days" there seemed to be a myth among some people in the industry that any kind of grain was good enough for the production of whiskey or spirits. Good distillery operations now demand corn at least two grades higher than that formerly known as "distillers' grade." Poor grain is apt to contain mold and possess a high bacterial count. Excess bacteria induce undesirable side fermentations which compete with the main yeast



**Twenty-four fermenting tanks in the Hiram Walker distillery. Capacity, 120,000 gal. each**


*By C. S. BORUFF and L. P. WEINER*

TECHNICAL DIRECTOR AND SUPERINTENDENT
HIRAM WALKER AND SONS, INC., PEORIA, ILL.


fermentation. As a result of these side fermentations, such undesirable volatile products as butyl alcohol, allyl alcohol, acrolein, and acetone develop in the fermenting beer, and they cannot be eliminated entirely no matter how fine the subsequent distillation and rectification. No grain should be accepted into a distillery until it has been properly sampled and passed by the control laboratory. Very rigid specifications regarding bushel weight, starch content, damage, dockage, mold content, frost-bite, moisture content, and, most important of all, bacterial count, should be adopted. Government and Board of Trade specifications alone are not rigid enough to exclude all undesirable shipments.

### Grain Handling

The old-fashioned distillery unloaded grain by moving it with a hand or power shovel from the grain car into an unloading boot located on the ground or recessed in the ground below the unloading doors of the cars. From this point either screw conveyors or bucket elevators conveyed the grain, together with all its refuse such as husks, cobs, dust, soil, etc., into the grain storage bins. Sometimes grain cleaning was practiced. For the most part the storage bins were merely wooden hoppers which were totally unsuitable for the sanitary storage of any perishable material such as grain. The operators knew little of the importance of clean grain although most of it was inspected for mold. Good practice today dictates the unloading of grain directly from the freight car by means of smooth, cling-proof sanitary metal tubes coming from exhausters so that in effect the grain floats upward through the tubes into smooth glazed concrete storage bins which are totally enclosed and which have no crevices or abrupt corners for grain to cling to and rot.

In the old days, it was general practice to grind a large amount of grain at one time so that the "boys could go home." This milling was really "pressure grinding" and was accomplished with hammer or burr mills. Such mills give grain an unusually hard treatment in that considerable heat is generated during the grinding operation. The grain is scorched and is well on its way to deterioration within a few hours after it leaves the mill. While some of the old distillers used roller mills, the highly refined roller mills in use today were not available. Today we find the modern distilleries equipped with three-high six-roll mills which are in effect three separate pairs of cutting rolls. Thus milling is accomplished in three gentle cutting stages and heating is reduced to a minimum. The corrugations on the various rolls are kept in good condition by grinding and corrugating machinery located on the premises.

Modern distillers grind but small amounts of grain at a time so that the natural bouquet of the grain is preserved and the tendency toward deterioration, which sets in as soon as the protective coating is removed from the grain, is reduced to a minimum. Here again the vacuum tube replaces the bucket elevators for conveying the meal from the mills to the meal storage hoppers. The same smooth-surface, concrete storage bins are in evidence with no openings except the few tight-fitting manhole covers for inspection and cleaning.

Those who knew the old distilleries will remember the meal scale floor as a place where a respirator was required in order to breathe properly. Meal was generally dumped out of the large hoppers into smaller wooden ones on rollers and these in turn weighed on

floor scales. The portable hopper was then rolled to a hole directly over the open mash tubs and the meal dumped in.

It is a far cry to the sanitary operations of today where meal is withdrawn through closed piping systems, weighed automatically and delivered through additional sanitary closed systems to modern pressure cookers. This is accomplished without any more physical effort than pushing several buttons. The operator's energies are left to watch and control other processes.

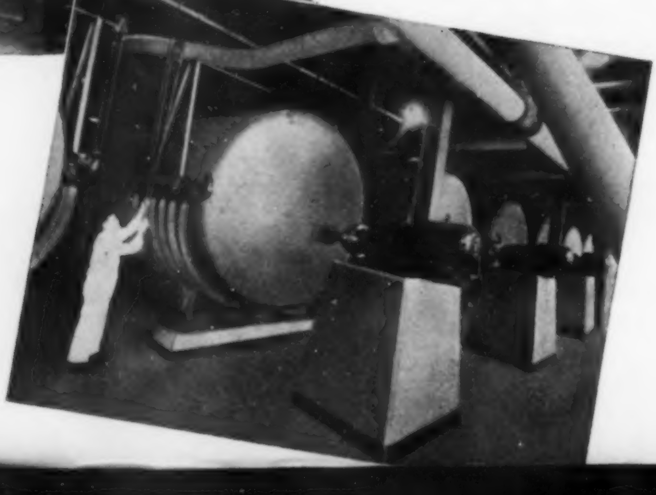
### Mashing

Before the meal can enter the fermenters it must be "mashed" and the solubilized starches converted into sugars. Years ago, and in many of the plants today, mashing was accomplished in wooden or metal mash tubs which were open vertical tanks generally with a conical bottom and having an agitator coming down through the top or up through the bottom and bearing many wooden or metal "sweeps" or "rakes." Inside and on the bottom of the mash tubs were bolted stationary sweeps or rakes to break up the mealy mass as it was mixed with the water that was added. One can imagine the difficulty of properly cleaning and sterilizing such a vessel and its internal contrivances. Also, as might be expected, all of the starch was not brought into solution by the cooking action of the steam coil in the bottom of the tub because of localized heat, improper agitation, and lumping of the meal and water. Later, when the mashing was completed and the malted grain meal added, the maximum amount of starch surface was not exposed to the action of the diastase of the malt, and incomplete conversion resulted. This unconverted starch led to low yields and undesirable fermentations. In any fermentation process the best quality of distillate is always accompanied by the highest yields, yet there are those today who believe there is no such relation. Some even go so far as to advertise that it takes more grain to make a gallon of their whiskey than it does other whiskies of the same type.

Today modern, completely enclosed pressure cookers are used for mashing grains. By the very nature of the principle of pressure cooking, it is easily possible to attain temperatures well above the sterilization point and to quickly gelatinize and solubilize all starches without any harmful effects on the grain. A pressure cooker can also be sterilized with live steam after the cooking has been completed. The advantages of this complete pressure sterilization over that which can be accomplished in an open tub under atmospheric pressure cannot be emphasized too greatly.

In a modern distillery the conditions for optimum cooking, mashing, and conversion are watched over by the control laboratory. Samples are collected in order to be sure that conversion is practically complete before the mash is sent to the fermenter and that the mash still possesses sustained diastatic activity.

**Three-high corrugated roll mills reduce the whole grain to a meal before it enters the cookers**



**"Mashing", conversion of soluble starches in the meal to sugars, is accomplished in these enclosed pressure cookers**

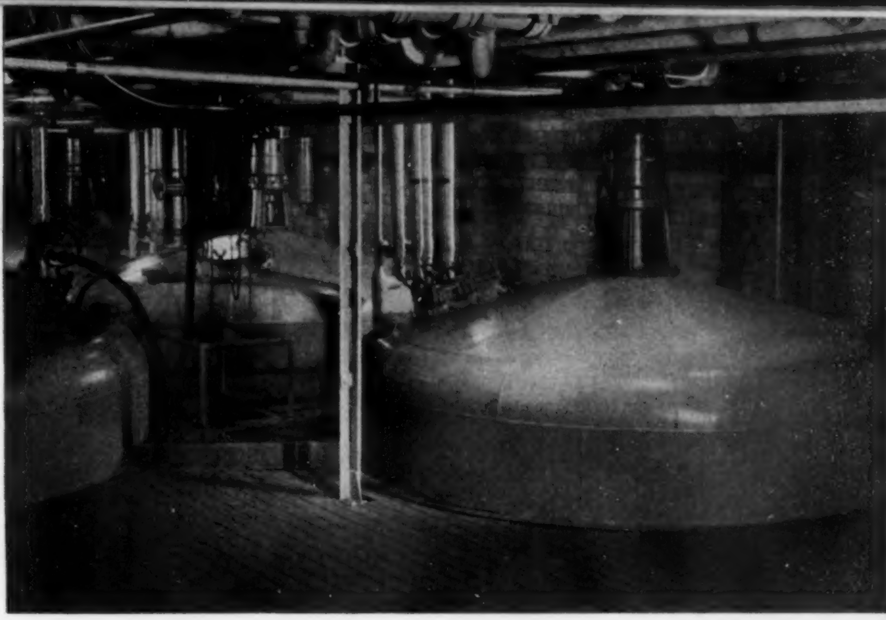
### Fermentation

Have you ever seen wooden fermenters in an old-style distillery? These fermenters were merely open top wood stave tanks bound together with trussing irons and equipped with wooden bottoms generally pitched to one side to facilitate draining. By the nature of the porosity of wood and the number of joints between the various staves, breeding and hiding places were provided for bacteria that are always ready to live and multiply where they can find food. It has been reported that it was no uncommon sight to see flies, and occasionally rats or mice, floating around on top of the beer in these open fermenters. After emptying such a fermenter, the best the distillers' men could do was to enter it with boots, hose, and buckets of lime water to whitewash the inside and attempt to sweeten it somewhat before refilling.

Modern distillery fermentations are conducted in closed-top, alloy-steel fermenters which are shaped gracefully not only to please the eye but also to eliminate possible lodging places for any sort of dirt or bacteria. Such fermenters are equipped with automatic high-pressure, high-temperature, water-washing devices that revolve and spray the inside surfaces of the fermenter with boiling water. These fermenters are also equipped with copper tempering coils supplied with cold water and controlled with automatic controller-recorders so that any predetermined temperature of fermentation can be maintained at all times.

Samples of the "set fermenters" are always collected by the control laboratory, and acidity, pH, and balling data are recorded. If the set acidity is not correct, it is regulated. All fermenters should be mixed daily with carbon dioxide gas and samples checked by the laboratory. The rate of fermentation is regulated in order that the fermenter will be finished on scheduled time and that only the desired congeners are developed and these in the proper quantities. Through proper selection of grain, mashing procedures, yeast, sanitary operations and con-

trol of fermentation rates and temperatures, one can produce a clean beer, free of undesirable volatile fermentation products—a beer that following distillation at between 100 and 160 proof will give a stock that requires only natural maturing in a barrel, and no corrective aging, to produce a balanced, clean, and mature whiskey. By careful control, both higher yields and higher quality are realized.



**9,000-gal. tubs equipped with automatic controls for yeast production**

### Distillation

A relatively large amount of money is required to operate even the smallest distillery, because the financing of maturing whiskies entails considerable working capital. Therefore, only the large distilleries can afford to install all the necessary equipment for accurately controlling all operations. Whiskey can be distilled in a collection of old pots, pans, cans, and pipes or in a hundred thousand dollar still, but what a difference in the final product. Few distilleries can afford to install and keep in operation the several different types of stills which are necessary to better produce different whiskies. There are really only two general types for producing whiskey: one, the pot still or variations such as the simple batch still, and two, the continuous still. The pot still may be merely a kettle wherein the alcohol is boiled off and condensed but this type is not in general use in the United States. More generally the type of still used is what is known as a beer still, which operates by boiling a batch of beer placed in its kettle, condensing the alcoholic vapors and possibly redistilling the resulting distillate in order to purify and "develop it" further. In distilling from such a still either all or any part of the undesirable distillate recovered at the beginning and the end of the distillation may be taken out by more or less inaccurate methods of discarding the early and latter part of the run into separate heads and tails tanks. In operating a continuous still the fermented mash is constantly fed in at an even rate and the whiskey and grain residue drawn out at an even rate. Various reflux ratios can be set with a consequent variation in the body or type of whiskey produced. Also, a uniform amount of aldehydes or heads can be withdrawn from such a still while in continuous operation although this withdrawal is not necessary or even advisable if a clean fermented mash is used as feed. Controlling the beer input temperature, the temperature and rate of distillation, the temperature and quantity of water wash in the wine plates, the reflux ratio and the temperature of condensation of the distillate vapor, constitute the vital points of distillation control. Engineering progress has played an important role in these operations by providing suitable automatic controlling and recording instruments. Temperatures, for instance, are controlled to within one-half of one degree. This spells uniformity of product and is quite different from the old time method of operation where the distiller or "beer runner" operated the still to the best of his judgment and empirical training rather than according to predetermined standards based on scientific knowledge.

Suitable high wines storage space should be provided and samples of all distillates examined by the laboratory and "quality committee" prior to pumping to the cistern building where the whiskey is drawn off into charred barrels. Distillates that do not match standards in analysis, body, bouquet, etc., should be returned from the high wines department to the stills for redistillation or conversion to spirits. Such a procedure will insure uniformity of product.

### Predetermined Whiskies

Through research studies we have been able to determine why different whiskies require different maturing times. Likewise, these studies have indicated the desirables and undesirables in a distillate and the source of each. On the basis of this knowledge, we are now able to design and manufacture whiskies of various bodies that will mature at any desired age, the program or method of manufacture differing in accordance with the desired maturing age. The old-fashioned and common production method today is for each distillery to make one or two distillates which it uses for all ages of whiskies. When sufficient stocks are available the distiller increases the age, the product eventually becoming a "Bonded Whiskey." If a particular whiskey is best when it is four years old, how can this same whiskey be considered a quality whiskey at one year or two years of age?

Designing and producing predetermined whiskies that are clean, mellow, balanced, and mature at ages ranging from three months to six years, is a reality at the Hiram Walker plant. All this has been accomplished through exhaustive studies of all variables and by putting all processes under strict control. No artificial aging methods have been found that even approximate the accomplishments that can be obtained by merely controlling the "natural processes."

At the last exhibition held in Cologne in 1934 this hall was devoted to autogeneous welding equipment

# GERMAN INDUSTRY PREPARES for ACHEMA VIII

*By PAUL WOOTON*

WASHINGTON CORRESPONDENT, McGRAW-HILL PUBLISHING CO.

**Returning on the S. S. "Bremen" on March 31, brimful of information and enthusiasm, our correspondent reports here some of his personal observations and experiences that will be of interest to chemical engineers who are planning to visit Europe this summer. Mr. Wooton brought with him the itinerary of an inspection trip planned to German industries and research laboratories, mimeographed copies of which are available at this office.—*Editor.***

ENCOURAGED by the success of the trade fair held in Leipzig (February 28 to March 9) the management of Achema VIII, the chemical engineering equipment exposition to be held in Frankfort-on-Main, July 2-11, is well advanced in its plans to stage the most ambitious exhibition of the sort ever undertaken. Plans are being made to entertain 75,000 visitors, an increase of 25,000 over the registered attendance at the last exhibition held in Cologne in 1934.

While the latest design in process equipment, scientific instruments and similar accessories will be shown, the greatest drawing card of the exposition will be the large-scale equipment for synthetic rubber, plastics, synthetic fibers and artificial textiles.

All of the space available for the 1937 show has now been reserved. The number of exhibitors will be 33 less than at Cologne three years ago when the total number was 367. The exhibits themselves, however, will cover nearly 10,000 sq.ft. more floor space. Were the visitor to spend ten hours a day looking at the exhibits during the full nine days of the Fair, he would have to devote less than 15 minutes to each one. And to do this he would have to traverse 7 miles of aisles.

Frankfort undoubtedly is the logical place for such an exposition. Not only is it Germany's chemical capital, but it has permanent buildings suitable for such an event. The writer went through the buildings and grounds in March and was impressed with the adaptability of the layout. The grounds are extensive. The ample areas between buildings are well landscaped. In addition to the seven exhibit halls, there is a restaurant, a moving picture theatre, a Foreign Visitors' Club and three lecture halls.

The imposing main building known as Hall 1 has been set aside for measuring, regulating and controlling instruments and all sorts of laboratory equipment and devices. Hall 2 occupies a 25,000 sq.ft. wing of Hall 1 and will be devoted principally to chemical stoneware, glass and other non-metallic equipment. What is being heralded as the first really comprehensive exhibit of synthetic rubber products will be shown in Hall 3-A (10,000 sq.ft.). It will include demonstrations of the unusual resistance to abrasion which is claimed for belts, tire treads and other products containing synthetic rubber. Exhibits of plastic materials will be another feature in this hall. One piece of process equipment, 60 ft. long and 10 ft. high, made entirely of plastics, will be shown. The 20,000 sq.ft. of Hall 3 will be utilized for the display

of the working models and largest scale machinery. The adjoining Hall 4 will also include larger equipment, featuring especially a display of packaging and bottling machinery and of new materials used in packaging in Germany.

A unique feature of the German display is the practice of equipment manufacturers to exhibit some recently fabricated piece of machinery which is about to be shipped to the purchaser. Therefore it is impossible to predict the exact character of these exhibits, but it is definitely known that at least one of the large displays will be a section of a synthetic ammonia plant, now on order, showing certain new features.

The exposition is being sponsored and managed by the German Association of Chemical Engineering Equipment Manufacturers (Deutsche Gesellschaft für Chemisches Apparatewesen) generally known as "Dechema." The exposition itself is know as Achema and since this is the eighth of the series it is labeled, Achema VIII.

Since 1925 the expositions have been under the supervision of Dr. Herbert Bretschneider whose driving force and congeniality, according to chemical manufacturers, are chiefly responsible for the continued success of the shows. He has made an unusual effort in connection with the preparation for Achema VIII but ascribes the promise of unprecedented success to the world recovery of chemical industry. The passing of the war scare in Europe removes a factor which might have militated against foreign attendance.

Dr. Bretschneider, well-known to many American chemical engineers is a Saxon from Leipzig, where after completing his technical education, he formerly managed a chemical plant. He is not willing to make an estimate as yet as to the foreign attendance, but judging from the number of foreigners who attended the Leipzig Fair, a larger proportion of visitors from other countries than at previous Achema is regarded as practically certain. "German chemical industries," says Dr. Bretschneider, "are making more fundamental progress than ever before. American chemical manufacturers and engineers know that we are pioneering some new developments in this country. My guess is that a good many of your countrymen will want to acquire first-hand knowledge of what is being accomplished and will be in attendance. They will be very welcome. We are prepared to show them our plants, our equipment, our prize scenic attractions and to allow them to commune with us at our many historical shrines."

It happens that the 50th anniversary of the founding of the German Chemical Society falls in 1937. The extraordinary annual meeting in commemoration of this anniversary will be held in conjunction with Achema VIII. A program dealing with significant scientific and technological developments is being arranged. The International Standards Conference will also hold a symposium on corrosion standardization and several other meetings are scheduled in connection with the exposition.

Now, may I add a few personal observations? To me one of the most remarkable sights in Frankfort is the headquarters building of the I. G. Farbenindustrie, comparable in size and splendor with any of the new departmental structures in Washington. It is faced with travertine marble from Italy, which has been used extensively for similar construction only at the Vatican. "The Pope and the I. G. only can afford to use it," a proud Frankfurter told me. Deutsche Gold und Silber Scheidenanstalt and the Metallgesellschaft also have their main offices in Frankfort, to say nothing of many chemical enterprises of the vicinity.

My feeling is that it is worth the trip to Germany just to see quaint Frankfort, where an enterprising, up-to-date, twentieth century community does business in medieval surroundings. Charlemagne used to live there. German kings were crowned there from the tenth century until relatively modern times.

Doubtless there are chemical executives and engineers, especially in the food industry, who would feel a certain satisfaction in eating a frankfurter on the very spot where it was first concocted over 375 years ago. The little open-front establishments continue in the hands of the descendants of the family which gave this sausage to the world. The house in which Goethe was born is the shrine which tens of thousands visit annually.

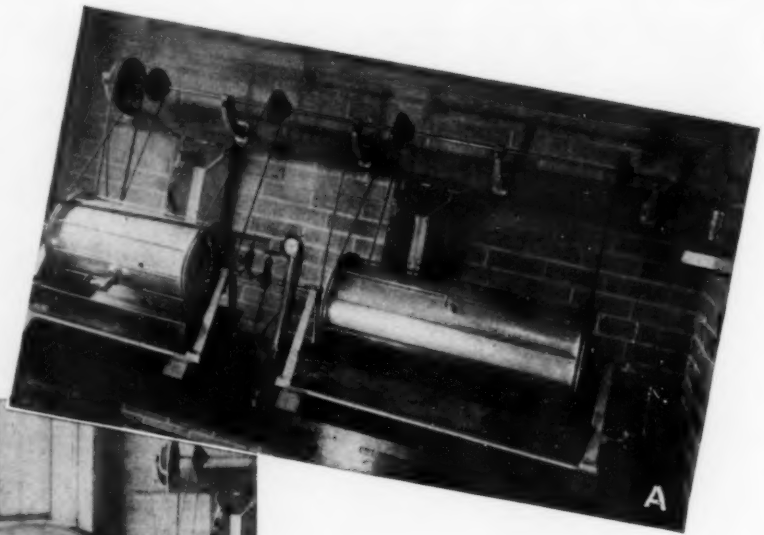
Practically everything is a bargain in Germany when registered marks that cost approximately 20 cents each can be employed and they may be used for everything except purchases for resale or the payment of debts. Good German wine for 35 pfennigs a pint, eight cents in U. S. currency, is one way to spend your money.

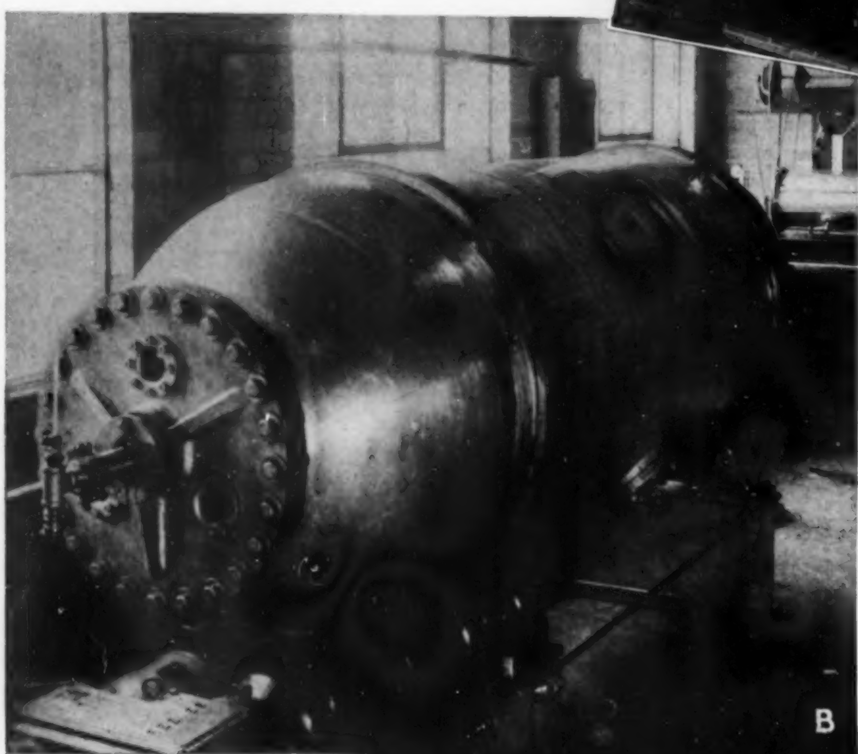
An all-expense, sight-seeing trip to the principal industrial centers of Germany which will cost 497 Marks (about $175-$200) has been arranged by Dechema for American visitors. Places will be visited in the following order: Eisenach, Merceburg, Madgeburg, Berlin, Potsdam, Dresden, Munich, Stuttgart, Heidelberg, Darmstadt, Wiesbaden, Cologne and Essen. The journey from Wiesbaden (Biebrich) to Cologne will be by steamer, down the Rhine.

On Sunday, July 4, there will be a choice of three single-day trips. One is to Heidelberg, a second is to the bathing resorts of Bad Neuheim and Wiesbaden. The third is an all-day steamer trip on the Rhine.

American visitors to Achema who do not speak German will have no language difficulties. Germany prides herself on the fact that she comes nearer being a bilingual country than does any other. Interpreters are furnished gratis at the exposition to all non-speaking German visitors. The writer, with a vocabulary of less than 20 German words, gratifying his penchant for poking about among the cheaper restaurants and out-of-the-way places, had no difficulty. Take along a little English-German dictionary and show them the word you mean if you can't pronounce it. Taxi drivers can read an address readily when they may have difficulty understanding your pronunciation of the destination. Anyway the house number is likely to be higher than you have learned to say. Aside from business reasons, which are many, for a visit to Achema VIII, it offers an opportunity for a cheap vacation and change of scene. Tourist class on North Atlantic liners now provides more lavish accommodations than most American hotels.

# NEWLY DESIGNED EQUIPMENT FOR MOLD FERMENTATION





A. Laboratory-scale fermenters used for process development. B. Large-scale fermenter, with drum 3 ft. by 6 ft. of 3/8 in. high-purity aluminum sheet (99.5 per cent Al and less than 0.1 per cent Cu, Fe and Mn) with end castings of aluminum-silicon alloy, 95 per cent Al, 5 per cent Si. C. Processing equipment, including cotton bag filters above aluminum solution tanks, small vacuum still with condenser, and accessories.

Exterior and interior views of new byproducts laboratory at Ames, Ia.

# TRANSLATING MOLD FERMENTATION RESEARCH TO PILOT PLANT OPERATION

*By P. A. WELLS, D. F. J. LYNCH*
*H. T. HERRICK and O. E. MAY*

INDUSTRIAL FARM PRODUCTS RESEARCH DIVISION, BUREAU OF CHEMISTRY AND SOILS, U. S. DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.

PART of the research program of the industrial farm-products division of Bureau of Chemistry and Soils, of the U. S. Department of Agriculture, is being directed toward the industrial utilization of agricultural products by fermentation methods. Recently, the adaptation of a laboratory-scale apparatus for carrying out submerged mold fermentations to semi-plant scale operation has been successfully accomplished at the Agricultural By-Products Laboratory, Ames, Iowa.

The first process to be studied with the large-scale equipment was the production of gluconic acid. The results, first obtained in a small laboratory-scale equipment, have been translated to larger-scale operation with unusual success. High yields of gluconic acid, coupled with a remarkably short fermentation period, should reduce the cost of production of this acid to a point where its application in industry will prove attractive. Studies of other processes will also be carried out, for it is anticipated that the type of equipment now employed will have a wide application in the fermentation industry.

The apparatus consists of a hollow, cylindrical, rotating drum, mounted horizontally and equipped on the interior with buckets and baffles welded to the shell. These serve to keep the fermentation culture thoroughly mixed with the liquid substrate and to stir into the fermenting mass humidified sterile air which is passed through the drum under pressure to provide the oxygen necessary for the life processes of the fermenting organism. Means for charging and emptying the drum, and for sterilizing it, are provided.

Contribution No. 272 from the Industrial Farm Products Research Division, Bureau of Chemistry and Soils, U. S. Department of Agriculture.

The fermentation drum, including all interior equipment, is constructed of high-purity aluminum, an essential since the presence of appreciable amounts of other metals exerts an unfavorable or toxic action on the fermenting organism. The total capacity is 420 gallons. In the work so far done, one-third of this capacity has been used for the charge; but it is possible that this may be increased somewhat. The base and driving mechanism may be of almost any design. It is only necessary to make proper provision for adjusting the speed of rotation.

The shafts at the ends of the drum are constructed of high purity aluminum and the portion of the shaft around which the drum rotates is fitted with a bearing-bronze sleeve. The stuffing boxes are made of cast iron, thus eliminating all aluminum bearing surfaces. Soft asbestos rope impregnated with cup grease has proved to be the most satisfactory packing for the stuffing boxes.

THE large-scale fermenter differs in only a few details from the laboratory model. The ends of the large drum are hemispherical in shape for structural reasons, but the buckets and baffles extend along only the cylindrical portion. This construction provides a free space at each end into which the liquor is not spilled. This serves to keep the inlet and exit tubes free of mold growth and prevents their clogging. The large fermenter is provided with an aluminum pipe attached to the interior surface of the drum and coiled back and forth around the ends of the baffles and buck-

ets. This pipe extends around one-third of the periphery on the side opposite the handhole. When the pipe is connected to a steam line and drain, it provides a means of sterilizing the drum and its contents by heat.

The large fermenter is charged and operated as follows: A metered quantity of water is added through the inlet tube. The glucose and nutrient salts are then poured in through the open handhole and, after closing the latter, the drum is rotated for a short time to dissolve the sugar and salts. Steam and drain connections to the built-in aluminum pipe are made and the drum and contents are sterilized. The sterile charge is cooled by passing water through the pipe used for heating and then sterile calcium carbonate and mold for inoculation are added through the handhole.

In the process now under study, spores of *Aspergillus niger* are germinated for 24 hours in the two small fermenters. The inoculum so prepared may be blown directly from the small drums to the large one by using a hose connection. The air pressure is adjusted to 30 lb. gage pressure and the correct amount of air, 7 cu.ft. per minute, measured by means of a flow meter, is then passed through the drum. The speed of rotation is adjusted to 10 r.p.m.

The course of the fermentation is followed by analysis of small samples taken at four-hour intervals. After the initial lag, which usually occurs during the first few hours, the fermentation proceeds rapidly, eventually reaching a point where the actual glucose concentration, initially 15 per cent by weight, decreases at the rate of 1 per cent per hour. The process is completed in 24 hours with practically quantitative conversion of the glucose to gluconic acid.

The converted fermentation liquor is blown through an aluminum pipe line to heavy cotton bag filters, the free acid is neutralized with lime, and the calcium gluconate is allowed to crystallize. The crystals are centrifuged, washed with cold water, and dried. The vacuum still is used to concentrate the mother liquor and washings to a point where further crystallization can be effected.

The work so far has revealed no essential differences in the manner in which the fermentation proceeds in both the small and the large-scale apparatus. Various details of economy of operation on the large-scale remain to be established, but the initial results have shown that this type of equipment is applicable to industrial use. It should prove to be advantageous for similar processes in the fermentation industry.

# Corn Proteins Offer Industrial Possibilities

*By J. F. WALSH*

DIRECTOR OF RESEARCH, AMERICAN MAIZE-PRODUCTS CO. NEW YORK, N. Y.

CONSIDERABLE study of the isolation, identification and characteristics of corn proteins has made possible the development of a wide range of these substances for industrial uses. As in the case of proteins in general, corn proteins are separated and classified according to their selective solubility in various solutions. Broadly, they are comprised of albumins, soluble in water; globulins, soluble in dilute salt solutions; glutelins, soluble in dilute alkalis; and prolamines, native only to grains, soluble in aqueous alcohol solutions.

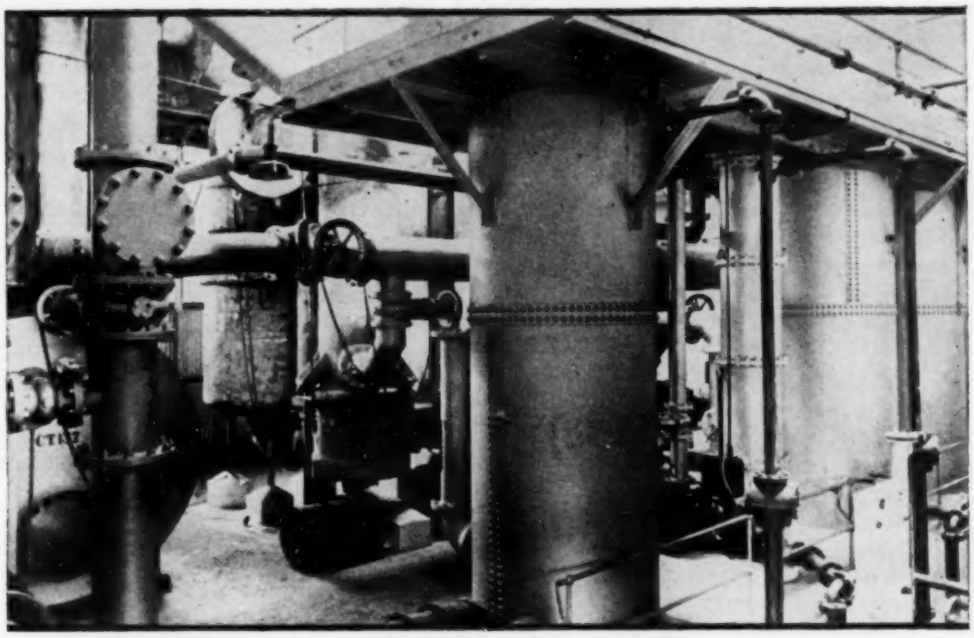
The proteins constitute about 10 per cent by weight of the corn substance and are isolated chiefly in the commonly known "gluten," the process waste separated from the starch in its purification. These proteins are all substantially insoluble in water. The water soluble albumins, and some of the more soluble globulins, are removed from the corn in the steeping process. The gluten, because of its high protein content—about 50 per cent—is taken as the base from which the various industrial proteins are isolated.

The first of three general industrial types, the carbohydrate free protein, finds its principal use in the plastics field as a base, filler, and reactive component in cellulose derivatives, natural and synthetic resins and also as a raw material for the preparation of amino acids, particularly glutamic acid and leucine. This group of whole proteins is in general thermoplastic, relatively light colored, and reactive to dilute alkali solutions, formaldehyde, phenols and aqueous alcohol solutions, and thus offers a base for a relatively wide range of plastic products and fillers.

The carbohydrate, alcohol-soluble free proteins, which make up the second industrial group, differ from the former type in that they are practically completely soluble in dilute alkali and substantially insoluble in aqueous alcohol solutions. Comprised principally of the glutelins and a small amount of globulins, they find use as a filler, as a component of phenolic resins, and as a base in alkaline coating solutions.

The third and most important group constitutes the aqueous-alcohol-soluble prolamines, known as "zein." This substance is a white, odorless and tasteless amorphous solid, similar in many of its properties and characteristics to shellac, casein, and cellulose esters, is thermoplastic, has a high electric insulation value, resists heat, is stable to light, and, while combustible, is non-flammable. Its chemical and physical properties make zein a highly suitable base for plastic and organic solvents, and dilute aqueous alkaline coating solutions. It is compatible with many of the cellulose derivatives, plasticizers, synthetic and natural resins, and can be compounded to transparent, stable compounds. It is relatively highly reactive, and consequently offers a prospective base for possible new synthetic resins. It can also be readily hydrolyzed to a wide variety of amino acids.

As these three proteins constitute about 10 per cent of the whole corn it can be seen that the potential available supply is large and is limited only by corn production.



This small but highly efficient contact plant produces 15 tons of sulphuric acid per day

# MONSANTO in ENGLAND

## How an old British industry became more American in method and direction

*Notes from an editorial travelogue*

**A few weeks ago Monsanto issued its 35th annual report which, as usual, is a model of timely and interesting information. One item in particular caught my eye. It was a brief reference to a program of expansion and modernization in the plant of Monsanto's 70-year-old British subsidiary, which since 1930 has been under the direction of my old friend and former teacher, Dr. Lloyd F. Nickell. This reminded me of a most interesting visit I made last summer to the historic old plant built along the riverside at Ruabon in North Wales, some 35 miles from Liverpool. While my associates were studiously participating in the annual meeting of the Society of Chemical Industry, I sneaked away long enough to study some chemical industry in the making. Perhaps the notes of my impressions, supplemented by a few snapshots of Monsanto's English plant, will be of interest at this time when that company is pushing ahead in the United States with the completion of its newest electric furnace plant in Tennessee for the production of phosphorus from phosphate rock. More about that in a subsequent issue, I hope. *S.D.K.***

BACK IN 1867, Robert Graesser founded a small chemical company in Ruabon, North Wales, to make paraffine wax and oil from the shale refuse of the local Welsh collieries. He had scarcely started before the flood of cheap petroleum, then beginning to be pumped out of the ground in America, almost put him out of business. In fact it did force him into another—tar distillation—but that also proved none too profitable because Ruabon was not near enough to the tar producing centers to compete with distilleries more favorably located. So the business tended toward specialization in refined phenol and cresol.

It is an interesting commentary that by 1887 this little plant accounted for well over half of the entire world's production of phenol. But then a new and serious competition arose in the shape of the rapidly growing dyestuff and organic chemical industry of Germany. Only because of greater emphasis on quality and constantly improved qualifications was "Graesser phenol" able to maintain its world-wide reputation. However, the company had also developed a number of related products such as picric acid and the aurine dyes, so when the European War broke out in 1914, this plant in North Wales became a logical and most important source of materials vitally needed by the British and French governments. A large synthetic phenol plant was built and it has operated successfully ever since.

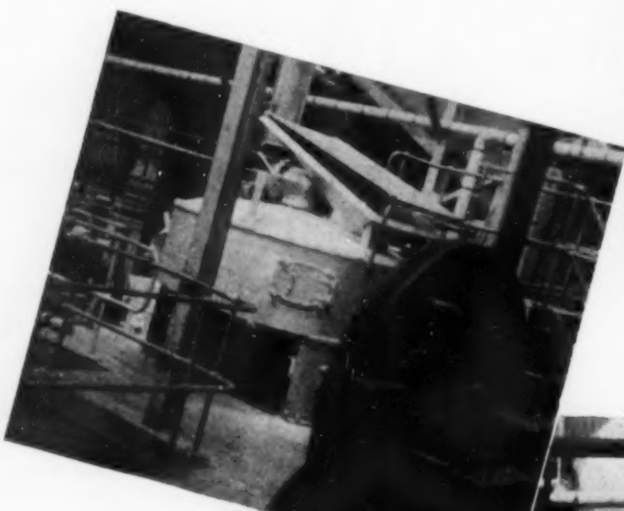
After the War, the logical trend of development was into fine chemicals, particularly salicylic acid and other derivatives based on phenol and cresol. This brought the Graesser company into competition with the British interests of Monsanto Chemical Works and in January, 1920, largely through the efforts of the late John F. Queeny, a consolidation was effected and Graesser-Monsanto Chemical Works was formed. Through the Monsanto influence, the business became more and more American in method and direction and a few years later, just before Mr. Queeny's death, entire control passed into Monsanto hands.

In January, 1930, the Wear Tar Works at Sunderland were purchased from Messrs. Brotherton & Co., thus broadening the base of Monsanto activities in England. About this time, Dr. Lloyd F. Nickell, who had been manager of the East St. Louis plant, was sent to England and shortly afterward inaugurated a program of modernization and expansion which has made Monsanto Chemicals, Ltd. one of the most important of the chemical companies in Great Britain, outside of the I.C.I. group.

To an American visitor the oldest parts of the plant, especially the natural phenol and cresol distilling operations, are interesting principally from an historical viewpoint. The output of the old equipment is small compared with the modern synthetic phenol plant nearby. Here benzol is treated with sulphuric acid to produce benzene sulphonic acid which is neutralized with sodium sulphite. The sodium salt thus formed is fused with caustic soda and the mass treated with water, yielding sodium phenate and sodium sulphite. The solid $Na_2SO_3$ is filtered off for re-use and the sodium phenate is acidified to give a crude phenol which must be distilled in vacuo to produce the finished product. It is significant that benzol is costlier in England than in the United States because of the higher prices for competitive motor fuels. Nevertheless synthetic phenol has proved a boon to British users, such as the plastics manufacturers who were formerly dependent solely on the tar distiller.

Salicylic acid is made at Ruabon from phenol and carbon dioxide. Formerly all of the $CO_2$ was purchased in cylinders but this is now recovered from the flue gas of the power plant, using the Girdler absorption process

**Dr. Lloyd F. Nickell, Chairman of Monsanto Chemicals, Ltd., since 1930**



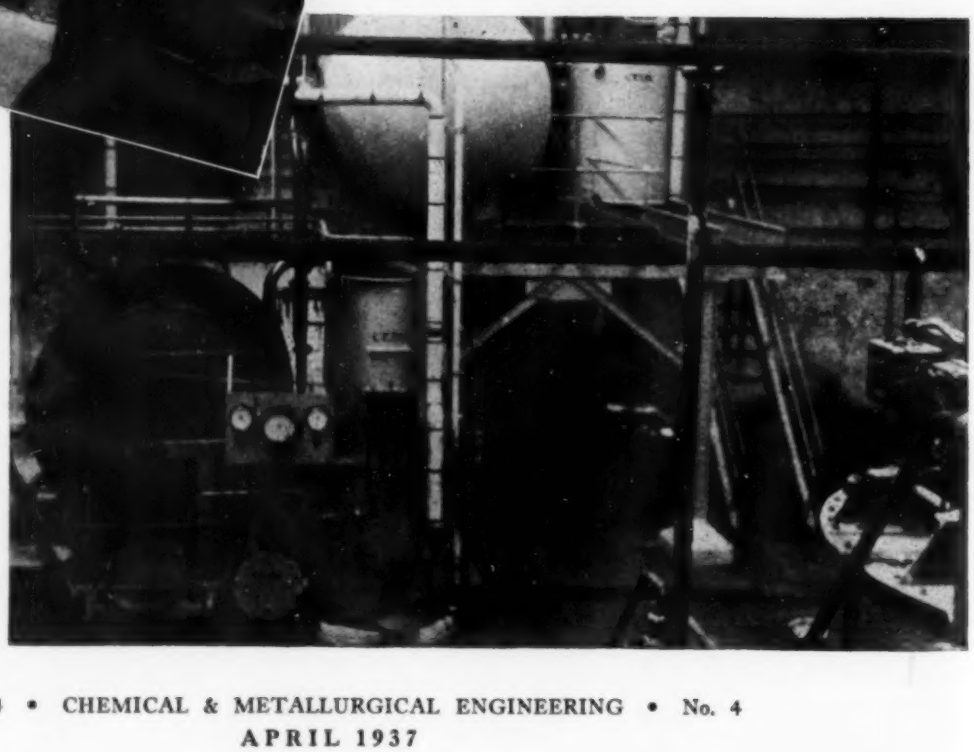
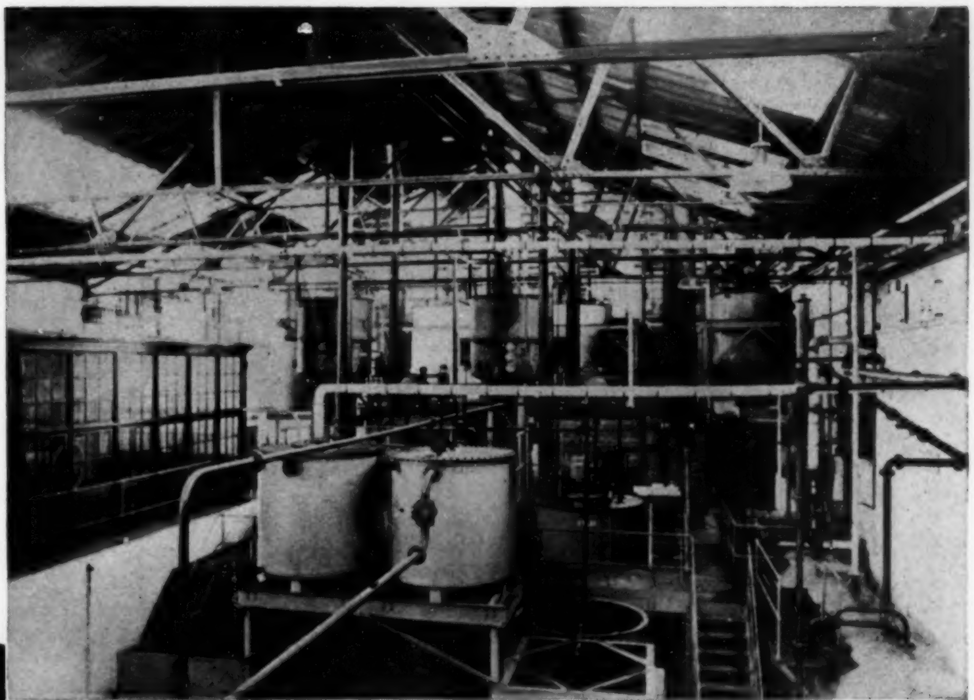


**Fig. 4. A drying pan for organic chemicals**

**Fig. 5. Rotary autoclave for synthesis of a rubber accelerator**

Phthalic anhydride is made at Ruabon by catalytic oxidation of naphthalene



Synthetic phenol plant for the benzene-sulphonic acid process

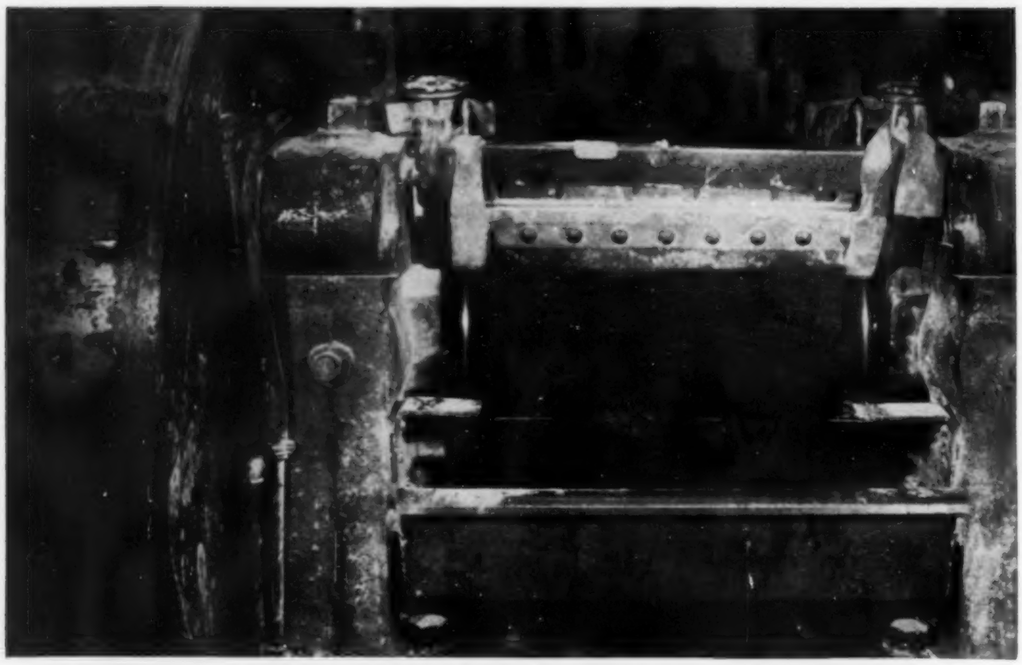
developed in the United States. As first installed, the process gave some corrosion difficulties, but these were removed by the development of an effective organic inhibitor. Another interesting problem was met in filtering the aspirin which is made from salicylic acid. Filters of chemical stoneware were formerly used, but it was found that the crystals actually penetrated into the pores of the stoneware, causing chipping and eventual rupture. This problem was solved by the discovery that aluminum is the most satisfactory material of construction in this application.

PHTHALIC anhydride is made at Ruabon in a thoroughly modern plant built about 1934. The chief raw material is naphthalene. Air is pumped through the naphthalene while in a molten condition and the mixed vapors are passed through the catalytic converters where the naphthalene is oxidized to phthalic anhydride which is purified by distillation.

The prize gem at Ruabon, however, is an extremely small but highly efficient sulphuric acid plant of standard Monsanto construction. Its rated output is 12 tons per day, but it normally operates at 125 per cent of capacity. By producing its own requirements of sulphuric acid, Monsanto effects a considerable saving even though sulphur is dearer in England than in the United States.

One of the most active fields of development in England and on the continent is in the production of rubber accelerators, antioxidants and similar chemicals such as Monsanto makes in this country through its associated Rubber Service Laboratories. Arnold H. Smith, who was one of the pioneers in that development in the United States, is a member of the London board of directors. He has had a part in the recent expansion of manufacturing operations and the development of a special laboratory fully equipped for testing and technical service to the rubber industry.

Monsanto normally employs about 600 men at Ruabon, with those in the plant working six 8-hour shifts while the office operates 5½ days a week. The plant manager is Dr. W. H. Garrett, who served as our chairman for the Management and Administration Section of the International Chemical Engineering Congress and has had an active hand in the development of safety work in Great Britain. To E. Mather, chief chemist, the writer is especially indebted not only for pleasant guidance through the plant, but also for photographs to supplement the work of the editorial camera.



**After chemical treatment the reclaimed rubber is worked on a refining mill in preparation for further processing**

RECLAIMED RUBBER is a product obtained by chemical treatment of vulcanized scrap rubber and therefore consists of crude rubber, sulphur in chemically combined form, oils, tars, dry compounds or fillers and other materials. The chemical treatment of the scrap renders it capable of being processed like crude rubber, that is, plasticized on mills, sheeted on calenders with or without fabric, extruded through tubing machines, compressed in molds, and, with the addition of new sulphur and other compounding agents, revulcanized.

As reclaimed rubber contains sulphur in combined form only, new sulphur must be added for vulcanization. When crude rubber is vulcanized with sulphur, part of the sulphur remains uncombined. When this product is reclaimed (known as devulcanization), part of the free sulphur is removed as sulphides in the reclaiming agent, the remainder further combining with the rubber. In neither process, vulcanization nor devulcanization, is any of the combined sulphur removed, and the latter, devulcanization, results in a further saturation of the unsaturated bonds of the hydrocarbon than the former, vulcanization, had already achieved. It is important to observe that when any of the bonds in rubber are saturated by addition of any element, this added substance can not be removed by any known means. Vulcanization, devulcanization, and aging, which is the addition of oxygen, are examples of such a reaction.

Reclaimed rubber can be used in almost every rubber product. Among its main uses are mechanical goods such as gaskets, packing, valve seats, and all kinds of hose, automobile attachments such as pedal pads, running boards, mats, and windshield wipers. It is used extensively in hard rubber products such as steering wheels and battery boxes, in heels and soles, and, of prime importance, in automobile tires.

### Effect of Reclaim on Compound Properties

Addition of reclaim to a rubber compound generally lowers the value of the physical properties of the compound. Properties of importance are tensile strength and stress at a given elongation, elongation at breaking point, resistance to abrasion, hardness measured as resistance to penetration, and resistance to aging. All these properties are measured by suitable testing devices in the laboratory and fairly reproducible results can be obtained. Addition of reclaim, or substitution of reclaim for crude, causes a definite decrease in all properties, generally as a straight line when they are plotted against per cent reclaim. The effect of this phenomenon on the technological importance of reclaim in the tire industry will be shown for the three divisions of a tire: the tread, which acts as cushion and shock absorber, the carcass, and the bead, which holds the tire on the rim of the wheel.

A typical tread compound using no reclaim consists of:

| | Lb. | Cost |
|---|---|---|
| Smoked sheets | 100 | $21.00 |
| Zinc oxide | 5 | 0.25 |
| Gas black | 45 | 2.25 |
| Pine tar | 3 | 0.09 |
| Stearic acid | 4 | 0.44 |
| Antioxidant | 1 | 0.60 |
| Accelerator | 1 | 0.50 |
| Sulphur | 3 | 0.08 |
| Total | 162 | $25.21 |

The cost per pound of this compound is 15.6 cents.

# Technological Importance of
# RECLAIMED RUBBER

**This paper was awarded the first of two prizes in the student paper contest sponsored by the New York Section of the A.I.Ch.E. The second went to I. R. Landau, of the University of Pennsylvania. Held at Brooklyn Polytechnic Institute, the competition included representatives from seven A.I.Ch.E. student chapters in the metropolitan district.—Editor**

*By DAVID S. PLUMB*

PRINCETON UNIVERSITY CHAPTER, A.I.CH.E.
PRINCETON, N. J.

An almost identical compound, but one which uses 16 per cent reclaim on the crude, consists of:

| | Lb. | Cost |
|---|---|---|
| Smoked sheets | 100 | $21.00 |
| Zinc oxide | 5 | 0.25 |
| Gas black | 50 | 2.50 |
| Pine tar | 3 | 0.09 |
| Stearic acid | 4 | 0.44 |
| Antioxidant | 1.25 | 0.75 |
| Accelerator | 1 | 0.50 |
| Sulphur | 3.25 | 0.08 |
| Whole tire reclaim | 16 | 0.88 |
| Total | 183.50 | $26.49 |

The cost per pound of this compound is 14.4 cents.

A typical product, a 600/16 six-ply automobile tire, has a tread weight of 11.4 lb. The value of the material in this tread using no reclaim is $1.78 while if the 16 per cent reclaim formula is used this value reduces to $1.67, a saving of 11 cents per tire.

LABORATORY abrasion tests give only an indication of what is to be expected from a compound when in use. The most satisfactory method of comparison of tread formulas is to tread half a tire with one formula, the other half with the second formula, run the tire a considerable distance on a car, remove it and compare the results of wear on the two treads. Data from such tests on the above two compounds show that the 16 per cent reclaim lowers the quality of the tread 14 per cent. A first-class 600/16 tire retails for $17.35. The 14 per cent quality decrease represents a loss to the consumer of $2.43. Such a large loss is not, however, usually entailed, for the tire containing reclaim would probably be rated as second quality, selling for $15.60, a saving of $1.75 to the consumer. The lower price is made possible by using cheaper fabric and generally cheaper workmanship besides the saving effected by use of reclaim. But the consumer loses 68 cents more in quality than the lower price represents, the manufacturer is unable to maintain the first quality profit, and the sale of the cheaper tire represents a loss to all concerned.

In contrast with the tread, reclaim can be and is widely used in the carcass. A typical carcass compound using no reclaim contains:

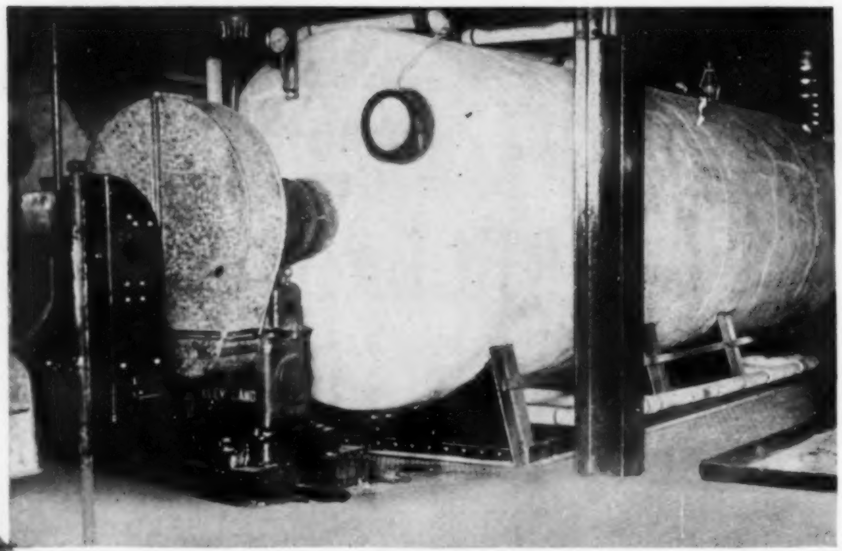
| | Lb. | Cost |
|---|---|---|
| Smoked sheets | 100 | $21.00 |
| Zinc oxide | 15 | 0.75 |
| Pine tar | 5 | 0.15 |
| Stearic acid | 1 | 0.11 |
| Sulphur | 2.5 | 0.06 |
| Accelerator | 1 | 0.50 |
| Total | 124.5 | $22.57 |

This compound has a specific gravity of 1.046 and costs 18.1 cents per pound. Using 50 per cent of a reclaim of specific gravity 1.16 gives the following carcass compound:

| | Lb. | Cost |
|---|---|---|
| Smoked sheets | 100 | $21.00 |
| Zinc oxide | 15 | 0.75 |
| Pine tar | 5 | 0.15 |
| Stearic acid | 1 | 0.11 |
| Sulphur | 3.1 | 0.08 |
| Accelerator | 1 | 0.50 |
| Whole tire reclaim | 50 | 2.75 |
| Total | 175.1 | $25.34 |

This compound has a specific gravity of 1.079 and costs 14.5 cents per pound. Finally, a carcass compound using 100 per cent of the same reclaim on the weight of crude can be used:

| | Lb. | Cost |
|---|---|---|
| Smoked sheets | 100 | $21.00 |
| Zinc oxide | 15 | 0.75 |
| Pine tar | 5 | 0.15 |
| Stearic acid | 1 | 0.11 |
| Sulphur | 3.75 | 0.09 |
| Accelerator | 1 | 0.50 |
| Whole tire reclaim | 100 | 5.50 |
| Total | 225.75 | $28.10 |



In this devulcanizer the reclaiming agent removes as sulphides the uncombined sulphur contained in the scrap rubber

Worn out automobile tires are the reclaimer's chief source of raw material

This compound has a specific gravity of 1.098 and costs 12.4 cents per pound.

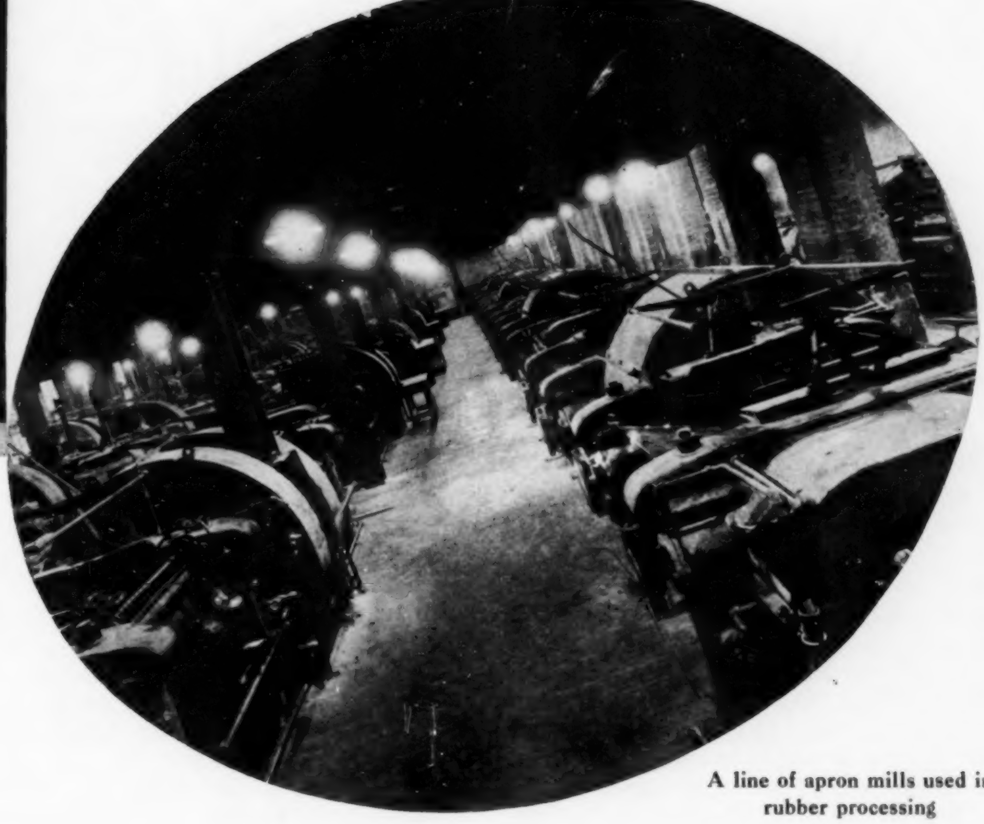
The carcass of the 600/16 tire weighs 7.1 pounds. Using no reclaim, this carcass would cost \$1.28 for material (excluding fabric). Using 50 per cent reclaim it would cost \$1.06 and using 100 per cent reclaim it would cost \$0.93. The two additions of reclaim represent a reduction of cost of 22 cents and 35 cents respectively, other costs of the carcass remaining sensibly constant regardless of compound used.

The first reclaim compound shows a lowering of 17 per cent in the tensile strength, based on the no reclaim compound. The 100 per cent reclaim compound shows a tensile strength of only 63 per cent of that of the no reclaim. This is the customary decrease in physical properties, but it has far less effect on the quality of the tire than would be expected. From a consideration of tire structure, it can be seen that the principal purpose of the rubber in the carcass is to act as insulation for the cotton strands which in reality bear the main stress of automobile operation. The rubber prevents chafing of the fabric and keeps the strands in place, the whole being only a support for the tube which holds the air. Consequently the only effect that a reasonable lowering in quality of the rubber in the carcass can have is an increase in the number of failures.

Again laboratory tests can give little indication of the value of the compound in practical use. Data on performance tests of the carcass is rather limited but is sufficient to indicate that 100 per cent reclaim in the carcass results in about 0.3 per cent increase in number of failures. This is an average figure. The top limit is 1 per cent but 0.5 per cent is a conservatively high figure. A tire failure is invariably returned to the manufacturer so the consumer loses nothing. On a second quality tire, returns of failures would only indicate 0.5 per cent of \$15.60 or eight cents. If the average returned tire is half worn out, and if the cost of manufacture, not selling price, is assumed as a basis, this figure reduces to three cents per tire, which is probably high. The net result is a saving to the manufacturer of 35 cents in cost of material per tire, a probable increase in manufacturing expense of three cents per tire or a saving of 32 cents on total cost of manufacture and no loss whatever to the consumer.

The final use of rubber in a tire is in the bead. Here reclaim is not only useful from an economic viewpoint but essential from a physical viewpoint. One common bead stock uses equal parts of whole tire reclaim and roll brown, a very cheap and poor quality rubber produced and treated by the natives in rubber producing areas. The remaining weight of the compound is filled out by whiting, zinc oxide and small amounts of other chemicals. The bead represents such a small portion of the cost of the tire that no economic features need be discussed.

These studies on tires indicate the utility of reclaimed rubber in automobile tires at the present time. The present price of crude rubber (February, 1937)



**A line of apron mills used in rubber processing**

**Reclaim supplied approximately one-fifth of U. S. consumption of rubber in 1935**

is about 21 cents per pound and reclaim can be sold for from five to seven cents per pound. Except under extraordinary conditions of world markets as occurred in 1932, crude will always sell well above reclaim. The use of reclaim is then feasible if not advisable in the tread, is economically advantageous in the carcass, and is definitely superior in the bead of automobile tires. The studies could be extended to point out the utility of reclaim in the innumerable other rubber compounds in common use.

In the event of war, the importance of reclaim would be even more apparent. During the World War, because of the scarcity of ship bottoms for transportation from sources of supply, crude was allocated to manufacturers in accordance with their importance in maintenance of war supplies. If the War Department had not excluded reclaim from its specifications for signal wire, tires, and other rubber products, a large number of bottoms would have been released to serve as transports to France. If the United States were completely shut off from the crude rubber supply, it would be entirely dependent on guayule, a bastard gum produced in limited quantities in Southern California and New Mexico, on reclaim and on synthetic compounds. The technological importance of reclaimed rubber, particularly in the tire industry, is then not to be underestimated.

The author wishes to acknowledge the aid of Mr. M. L. Allard, technical director of the United State's Rubber Reclaiming Co., Inc., under whom he has worked, and also to express appreciation to Mr. George Winchester of the Norwalk Tire and Rubber Co., Inc., who supplied some of the data. Further data were furnished from the files of the above two corporations and by the Association of Rubber Reclaimers.

# What Every Chemical Worker Should Know About Safety

By *JOHN S. SHAW*

MANAGER, SAFETY AND SERVICE DEPARTMENT
HERCULES POWDER CO.,
WILMINGTON, DEL.

IT IS DIFFICULT to separate the fundamentals of safety that every chemical worker should know from those that every industrial worker should know. At times, the dividing line is thin. Therefore, in discussing those things that the chemical worker should know in order to work safely, we shall have to include general as well as specific safety measures.

The "rules of the game" given the chemical worker are very complete in anticipating all possible hazards, thereby giving him the maximum possible protection. He should observe these rules religiously to avoid poisoning, burns, suffocation, or injury in an explosion.

Here are safety items that every industrial and chemical worker should know:

1. A chemical worker should be thoroughly familiar with the location and use of water hydrants, safety shower baths, fire blankets, exits, and fire fighting equipment. He should be shown through the medical or first aid department and understand the importance of reporting promptly for first aid treatment for injury resulting from contact with any chemical, as well as for physical injuries. He should be trained in first aid and his training reviewed at least every three years. Competent instructors should give the training. Instructive literature should be used from the American Red Cross, the Bureau of Mines, the National Safety Council, and other reliable sources.

2. The chemical worker should keep in a safe and proper place, always ready for use, any protective equipment supplied him, such as goggles, rubber gloves, aprons, boots, or other articles. Gas masks, whether they are hose or canister type, should be tried on at regular and frequent intervals to make sure they will be working properly when needed. A canister, if equipped with a recording device showing the strength of the chemicals contained has diminished materially, should not be returned to its original place but should be discarded immediately, before it is entirely exhausted. If there is no recording meter on the canister, it should be discarded at the end of each year; but if used, it should be discarded immediately after use.

Canisters should be kept sealed until used, but the sealing must not be forgotten when the mask is put into use. Loss of life has occurred through failure to remove the adhesive seal from the bottom of the canister in times of emergency and excitement.

I should like to emphasize the importance of mental rehearsals of emergencies. By this I mean that every chemical worker should not only experience physical rehearsals, such as safety drills, and life saving, but he should each day at his work imagine emergencies which might arise and mentally rehearse what he would do if something should go wrong. This is very important in the training of the chemical worker and not only does it lead to a broader knowledge and appreciation of his job, resulting in safer and more efficient operations, but often it has a direct bearing upon the creative impulse, resulting in improvements and inventions.

3. Exits should not be blocked at any time, not even momentarily, in the chemical plant, for the unforeseen may happen at any time, when quick escape may be necessary.

4. When going on duty, the chemical operator should satisfy himself that the operating equipment he is about to use is in good condition and working normally. He may receive warnings or instructions from the previous shift operator, and from his working superior, but, at the same time, he should take nobody's word for the "lining up" of valves on chemical, gas, or liquid lines, electrical switches, etc. He should go over his equipment and personally "line up" his own valve set-up, or whatever it may be.

5. Oftentimes, spills of liquid chemicals occur and when an operator observes a wet place on the floor, he should realize that he must not look up until he has retreated to a point where there will be no danger of splashes into his eyes or onto his body. This is an old rule of chemical workers, handed down from the age when chemical leaks and drips were frequent.

6. The chemical operator should realize that the control features on all chemical equipment are there not only for operating purposes, but, in most cases, for safety; and in the event that any pressure or vacuum gage, thermometer, or what not indicates abnormal change or a bad condition, he should take steps immediately to rectify the condition as specified by his superior, usually by reporting the condition promptly. However, there are emergencies when he must safeguard the situation before reporting. It is taken for granted that these emergency conditions are provided for in his training. It is impossible to do more than generalize on this without the danger of misunderstanding.

7. While "a little knowledge is a dangerous thing," the more the worker knows about the reasons for

following prescribed methods, the better worker he is. He should acquaint himself with the reasons, and, if possible, be familiar with the simple chemistry and physics of his job, and not be afraid to ask questions; but he should never experiment without the advice of proper authority.

8. When leaving his work, or outlining his duties to another at the termination of his shift, the chemical worker should fully familiarize his successor with the condition of the equipment and the status of the chemicals in process. This should be in writing in a log book of operations. By no means should he leave any questionable condition whereby his fellow worker may meet with a mishap. It is his full responsibility to live up to this and to consider it as sacred as anything in life. The slightest deviation from this practice, whether deliberate or otherwise, has meant disaster to chemical workers and monetary loss to plant owners.

9. The chemical plant is no place for monkey business or horseplay. It must be remembered that the practical joker may be a potential killer.

I have known chemical workers deliberately to plug condensers in order to see if their fellow workers could quickly discover and locate the trouble. Such methods should not be resorted to, even with only water in the equipment.

10. The chemical worker should thoroughly appreciate the fact that safety is sacred, that the safest method is generally the best method, and that the best method always embraces the safest way.

# Eye Hazards Require Varied Goggle Types

ON JOBS involving eye hazards, safety men have found that it is much easier to educate the workman in the importance and use of goggles if he is provided with the proper kind. Specifications for goggles guarding against various types of hazards have been suggested recently by the National Safety Council in its Safe Practices Pamphlet No. 14.

For protection against dust, it is pointed out by the Council that the goggles should be of a type which enclose the eyes completely. Whether they should be ventilated through minute holes or baffle slots depends upon the composition and quality of the dust, the size of the particles and the manner in which the dust is circulated. Dustproof goggles should be used wherever finely divided materials are handled or packed.

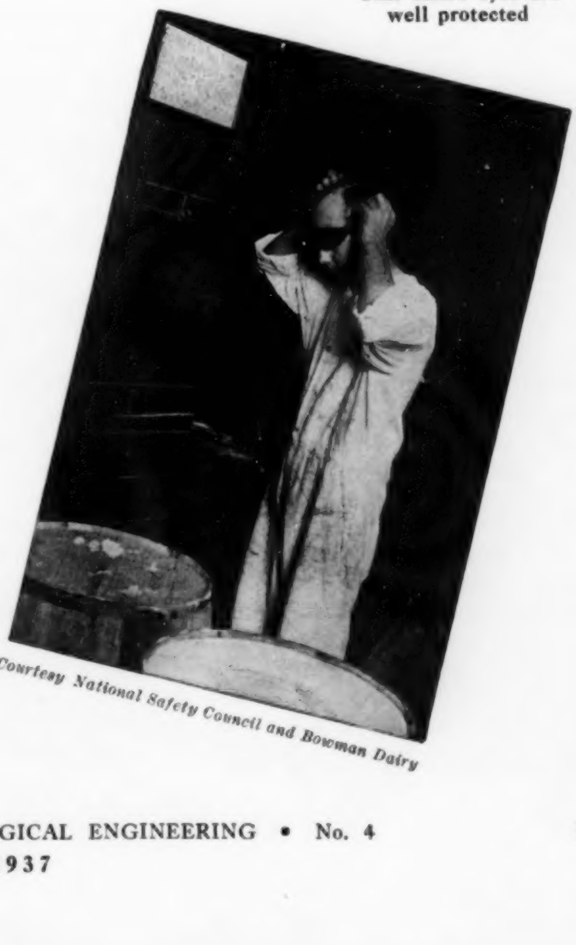
There are two kinds of splashes to guard against, namely, corrosive liquid and molten metal. To exclude liquid splashes it is necessary to have a tightly fitting goggle of the eyecup type made of a material which is impervious to chemicals and which makes a tight-fitting joint between the lens and its retaining ring. For molten metal a goggle is required which fits the face tightly, is of non-flammable material and does not fog easily.

Goggles for protection against fumes and gases should be similar to those for splashes except that there should be no ventilation opening.

Spectacles or eyecup goggles having lenses of colored glass are usually used for protection against glare. Eyecup goggles are used to protect the eyes against injurious light rays. The inside of the eyecup should have a non-reflecting finish and the ventilation opening should be so located that light does not enter through the opening in a manner to strike the eye. In the presence of the injurious infra-red and ultra violet rays, colored goggles should always be worn.

After determining the exact style of goggle to be provided, the factors of durability and comfort must be considered. The frames should be light but yet strong enough to hold their shape, should have a smooth finish and be of material which will not readily corrode. Eyecups are usually made of high-grade moisture resistant fiber or molded plastic materials. All eyecups should be so shaped as to form comfortably to the contour of the eye sockets and should be large enough to cover them adequately. The edges coming in contact with the face should be smoothly finished to avoid irritating or cutting the skin. All goggle lenses should have dimensions not less than 1.5 in. in the vertical direction and 1.75 in. in the horizontal direction. It is recommended that circular lenses be of a uniform diameter of 1.97 in. (50 mm.).

**This man's eyes are well protected**



Courtesy National Safety Council and Bowman Dairy

# Influence of the Solid on Flow Properties Of Dilute Suspensions

*By R. N. TRAXLER*

BARBER ASPHALT CO., MAURER, N. J.

SINCE the finely ground minerals used in filling and coating paper are handled and applied in the form of dilute suspensions in water, the flow properties of such slurries are of interest to the pulp and paper technologist. It would also be advantageous for him to know what properties of the dispersed, pulverulent solid influence its effectiveness as a filler or coating, and how these affect the viscosities of the slurries handled in the paper mill. Many other industries have sought answers to similar or related questions. The paper technologist may borrow with profit from the discoveries and experiences of the paint chemist, well-drilling expert, road builder, ceramist, and others in apparently unrelated fields.

In recent years a vast amount of work has been done in developing new methods of viscometry and in expanding the applications of older methods. A book *(1)* recently published in English by the Academy of Sciences at Amsterdam could be read with profit by anyone interested in rheology and viscometry.

From the results obtained using many different materials and various dispersed systems, several types of flow are now recognized. These types are most readily distinguished by the nature of the curve obtained by a plot of rate of shear versus shearing stress. Fig. 1 illustrates three different kinds of rate of shear-shearing stress relationships which may be obtained with liquid-solid systems. In Fig. 1A, which represents viscous flow, a plot of rate of shear versus shearing stress gives a straight line passing through the origin. The reciprocal slope of the straight line, which is constant over the entire range of shearing stress, evaluates the viscosity of the material (viscosity = shearing stress/rate of shear). Of course, the rate of shear must remain low enough to avoid turbulence. Many dilute suspensions of clay and other minerals are viscous liquids.

Fig. 1B shows the type of rate of shear-shearing stress curves obtained with systems which possess so-called non-Newtonian flow characteristics. Since for these materials plots of rate of shear versus shearing stress give various curved lines passing through the origin, the "viscosity" calculated decreases with increased shearing stress. If a viscosity value is reported for such a material the shearing stress or rate of shear used must be reported also. When the solid particles are present in sufficient concentration to possess some degree of orientation, and thus impart structure to the dispersion, the system becomes non-Newtonian or "quasi-viscous."

Presented at the annual meeting of the Technical Association of the Pulp and Paper Industry, New York, N. Y., Feb. 22-25, 1937.

Ideally, a plot of rate of shear versus shearing stress is, for plastic flow, a straight line which intersects the shearing stress axis at some point called the yield value. This type of flow is illustrated by Fig. 1C. Any shearing stress below the yield value will not deform the material permanently. The slope of the straight line obtained after the yield value is exceeded and flow occurs is a function of the mobility of the system. Recent investigations at low rates of shear have shown that instead of intersecting the shearing stress axis, the curves frequently bend sharply and pass through the origin. In order to possess "plastic" properties a suspension must contain a sufficiently high concentration of solid particles to create some state of packing.

HOBSON *(2)* has recently reviewed a large number of studies concerning viscometric measurements on clay slurries, and his bibliography would be valuable to anyone interested in this subject. The capillary tube type and certain forms of the rotating concentric cylinder type of viscometer seem to have been most generally used in the study of clay suspensions. At low concentration of solids where the suspension is a viscous liquid, some kind of capillary tube viscometer may be useful. However, when the concentration of the solid is increased to the point where orientation of the particles occurs and non-Newtonian or plastic flow appears, a viscometer of the rotating cylinder or disk type should be more suitable because equilibrium values can be obtained over a wide range of rates of shear with such instruments. Usually the solids will settle quite rapidly in the slurries employed by the paper maker; consequently, he will have to use a viscometer so designed that the solid particles can be maintained in suspension during the viscosity determination. A modified falling ball viscometer *(3)* might be successfully used with these dilute dispersions.

Many arbitrary methods have been proposed for measuring the flow properties of different materials. Although some of these methods may have practical value and be suitable for use with purely viscous liquids, they cannot give reliable information concerning the flow in systems which are non-Newtonian or plastic. Further, it is desirable that methods be employed by which the flow properties are evaluated in absolute units.

Liquid-solid systems of certain concentrations may become more fluid on stirring and thicken again when the agitation is stopped. Thixotropy is the name given to this reversible phenomenon. Gamble *(4)* has discussed thixotropy in oil paints and has shown that this property can be correlated with properties of such practical interest as pigment settling, brushability and levelling.

The solid particles used in filling or coating paper possess four primary physical properties which influence their value and efficiency for such uses. These properties are shape, surface texture, size and size distribution. Surface area per unit weight or volume may also be considered a primary property although it is dependent on the four properties just mentioned. The void content and average void size of the compacted powder are secondary properties governed mainly by the primary properties.

Average particle size and particle size distribution may be determined or estimated by a number of different methods. Work *(5)* has written an excellent review of the subject in which he classifies the methods used in size analysis as follows: Direct measurement 1. Sieving. 2. Elutriation or sedimentation. 3. Microscopic measurement.

Indirect comparisons 1. Settling rate in a fluid medium. 2. Apparent density or packing volume. 3. Hiding or light-dispersing power. 4. Rate of solution. 5. X-ray dispersion. 6. Plasticity. 7. Effects in products, such as rubber, putty, etc.

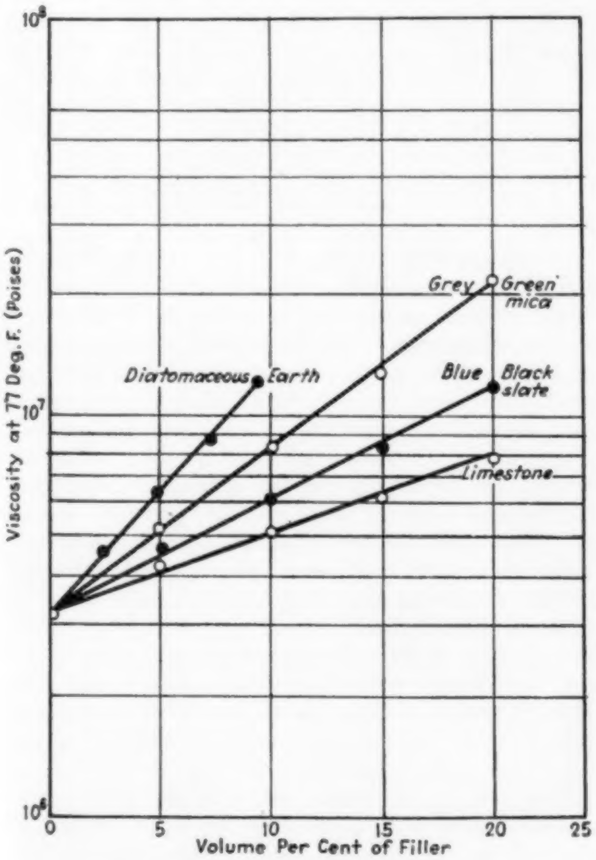



**Fig. 2—Viscosity-composition curves, asphalt-mineral powder mixtures**

Direct microscopic measurement probably is the most reliable method but it is fatiguing and time-consuming for powders possessing a wide range of particle sizes unless the examination is preceded by fractionation of the whole powder. For this purpose Roller *(6, 7)* designed an air elutriator or analyzer by means of which mineral powders can be separated into close size fractions. For powders passing a 200-mesh sieve it is common practice to separate into five fractions (-5, 5-10, 10-20, 20-40 and 40-80 microns). A micron is 1/10,000 centimeter. The following list gives the dimensions in microns of the openings in a number of the United States standard sieves.

| Sieve No. | Size of Opening (in microns) |
|---|---|
| 100 | 149 |
| 140 | 105 |
| 200 | 74 |
| 230 | 62 |
| 270 | 53 |
| 325 | 44 |
| 400 | 37 |

The particles in the fractions of close size limits obtained with the air analyzer can be counted and measured more rapidly and with greater accuracy than can the unfractionated powder. Projection of the image of the particle upon a screen should be used in counting and measuring the small particles ranging from 0.25 to 10 microns in diameter.

Odén *(8)* developed a sedimentation method for determining particle size distribution and applied his technique to the study of soils and clays. The Bouyoucos hydrometer *(9)* which has been widely used in making mechanical analyses of soils and clays could be, and probably is used in paper mills for estimating roughly but quickly the particle size and size distribution of the minerals used for filling and coating.

A turbidimeter for determining the particle size distribution in pulverulent solids has been designed by Wagner *(10)*. This apparatus utilizes a combination of Stokes' law of fall of solid particles through a

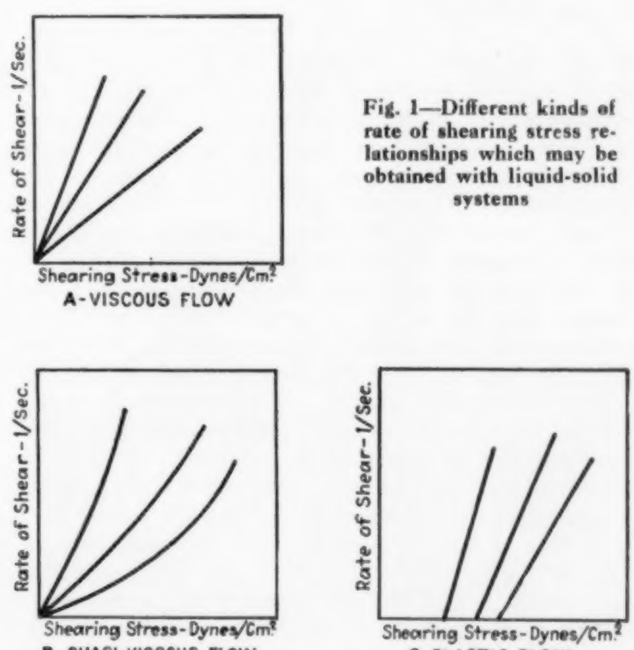



**Fig. 1—Different kinds of rate of shearing stress relationships which may be obtained with liquid-solid systems**

viscous medium and the law relating the turbidity of a suspension to the surface area of the suspended solid. The apparatus and technique, originally devised to measure the particle size distribution in portland cement, has been modified by Traxler and Baum *(11)* for use with other pulverized minerals. The method should be useful in paper mill control work on solids if the average particle size is not too small.

For very fine powders the centrifuge offers a means of obtaining a size analysis. Recently Hauser and Reed *(12)* have employed the centrifuge to determine distribution curves. Marshall *(13)* has used this instrument for the mechanical analysis of clay dispersions.

The engineer interested in the evaluation of particle size and size distribution and their relation to surface area should refer to the publications of Perrott and Kinney *(14)*, Green *(15)* and Hatch *(16)* who give complete discussions concerning the treatment of size and size distribution data.

Shape and surface texture of the solid particles probably have a marked influence on the value of a mineral for use in paper manufacture. Upon these properties will depend to a certain extent the retention of the filler or coating by the paper; the physical properties of the finished product will also be affected. Most clay particles are plate-like in shape but the ratio between the three axes (which defines shape) may vary greatly with the kind of clay and the degree of dispersion. Marshall *(13)* in discussing clays observed "that below 500 millimicrons the particles were not so markedly plate-shaped as those in the range 500 millimicrons to 2 microns."

A SIMPLE method for evaluating the shapes of solid particles might be useful in correlating this fundamental property with the practical physical characteristics created in the finished paper. The surface texture of the particles, although having an important bearing in many applications, will be difficult to evaluate quantitatively.

As mentioned previously, surface area per unit weight of volume is governed by particle size, size distribution, shape and surface texture. Various methods are available for estimating surface area all of which, however, are approximations. In cases where the law relating to the surface area of the suspended material to the turbidity of the suspension is valid, the turbidimeter is a useful instrument. Direct count and measurement of the particles followed by calculation of the harmonic mean diameter *(6)* make possible the estimation of surface area even when working with plate-like or acicular particles. Heywood *(17)* has written an excellent dissertation on the calculation of specific surface. His paper and the accompanying discussions are helpful in obtaining a clear understanding of this subject.

The per cent voids in a compacted powder is useful in evaluating the influence of the powder on the flow properties of a mixture of which it is a part; in general the higher the void content, the more effective the mineral. Bulk density determined by dry compaction of the powder is frequently used for the calculation of per cent voids. The dry powder is placed in a glass graduate which is then tapped by hand, preferably on a brick covered with a section of auto inner tube, until no further compaction occurs. From the volume and weight of the powder its "bulk density" is calculated. Knowing the density of the mineral the per cent voids may be calculated from the equation

$$V = 100 - \frac{B}{p} 100 \qquad (1)$$

where V = per cent voids in the compacted powder
B = bulk density of the powder in grams/cc.
p = density of the mineral in grams/cc.

Norton and Hodgdon *(18)* studied the porosity and particle spacing for a number of clays and other minerals under various conditions. Several methods for determining per cent of voids in compacted mineral powders were described by Traxler, Baum and Pittman *(19)* who also discussed the influence of particle size, size distribution, shape and surface texture on void content. Roller *(20)* studied the bulking properties of fine powders.

Although void content is useful in evaluating certain fillers it is likely to be unreliable when applied to clays and other finely divided solids whose particles are non-uniform in shape. Since these types of filler are used in paper manufacture, the more reliable evaluation described below is recommended.

THE average void size can be calculated from the permeability of a compacted, unconsolidated powder. An apparatus for measuring the rate of diffusion of air through a column of compacted powder has been described *(21)* and the equations given for calculating the permeability and average void diameter. Further, an empirical relationship has been found to exist between the per cent voids and average void diameter, which may be expressed as

$$\log d = m B + b \qquad (2)$$

where d = average void diameter in cm.
B = per cent voids.
and m and b are constants.

This equation with a value of 0.019 for the slope "m" has been found to hold for a large number of commercial mineral powders. Having determined experimentally the average void size for some easily obtained void content, "b" can be calculated. Then, it is possible by means of Eq. (2) to calculate, within certain limits, the average void size for any per cent voids.

For certain minerals, such as clay, mica, celite and asbestos, all of which possess particles whose three axes are non-uniform in length, Eq. (2) may not apply. However, for such materials the relationship between per cent voids and average void diameter may be established experimentally. Values may then be interpolated from a plot of per cent voids against the logarithm of void diameter.

In the laboratories of the Barber company many different powders have been mixed with asphaltic liquids to give viscous mixtures, and the viscosity of each mixture determined in absolute units (poises) at 25 deg. C. The volume per cent of liquid present in the mixture was assumed to be equal to the per cent voids in the dispersed solid. Then using this void content the average void size of the powder as present in each mixture was calculated using Eq. (2) or was

picked from an experimentally determined per cent voids-void diameter curve. From the data obtained on these mixtures it was found *(22)* that the viscosity of a liquid-solid system (where no chemical reaction occurs between the liquid and solid) is *inversely proportional* to the average void size of the powder as dispersed in the mixture.

**Table I.—Relationship Between Viscosity and Average Void Size**

| Mineral powder | Volume per cent mineral present | A Viscosity of asphaltic mixture at 25 deg. C. (poises) | B Diameter of average void in powder as present in mixture (microns) | A × B |
|---|---|---|---|---|
| Red Slate 5–10 microns | 10 | $8.92 \times 10^6$ | 15.0 | $134 \times 10^6$ |
| | 20 | $13.4 \times 10^6$ | 9.70 | $130 \times 10^6$ |
| | 25 | $16.4 \times 10^6$ | 7.79 | $127 \times 10^6$ |
| | 30 | $20.0 \times 10^6$ | 6.26 | $126 \times 10^6$ |
| Red Slate 20–40 microns | 10 | $8.83 \times 10^6$ | 47.1 | $416 \times 10^6$ |
| | 20 | $13.7 \times 10^6$ | 30.4 | $416 \times 10^6$ |
| | 25 | $17.1 \times 10^6$ | 24.5 | $418 \times 10^6$ |
| | 30 | $21.2 \times 10^6$ | 19.7 | $418 \times 10^6$ |
| Loess | 5 | $4.11 \times 10^6$ | 16.8 | $69.0 \times 10^6$ |
| | 10 | $5.19 \times 10^6$ | 13.5 | $70.1 \times 10^6$ |
| | 20 | $8.28 \times 10^6$ | 8.73 | $72.3 \times 10^6$ |
| | 30 | $13.2 \times 10^6$ | 5.64 | $74.5 \times 10^6$ |
| Talc | 20 | $12.5 \times 10^6$ | 4.70 | $58.8 \times 10^6$ |
| | 25 | $17.4 \times 10^6$ | 3.17 | $55.2 \times 10^6$ |
| | 30 | $24.7 \times 10^6$ | 2.22 | $54.9 \times 10^6$ |
| | 35 | $35.0 \times 10^6$ | 1.65 | $57.8 \times 10^6$ |

Table I gives data for several combinations of liquid (asphalt) and different mineral powders. It is evident that the average size of the liquid films and masses (identical with the average void size of the powder as present in the mixture) separating the solid particles is the factor governing the viscosity of a liquid-solid dispersion.

When the dispersions are more concentrated and the particles are in contact, the friction between them complicates the type of flow. The system has then become non-Newtonian (quasi-viscous) or plastic and the above relationship between viscosity and void size is no longer valid.

IN the effect of the average void size on the viscosity of a mixture we see the result of the combined influences of particle size, size distribution and shape since these are the properties governing the average void size (the average liquid film or mass) for any volume concentration of solid in a dispersion. The combined effects of all of the primary variables are measured by this secondary property of the powder.

Since the viscosity of a liquid-solid system appears to be inversely proportional to the average void size of the pulverulent solid as present in the mixture, it follows logically that as the concentration of the solid is increased (the average void size becomes smaller as the particles are brought closer together) the viscosity will increase. This has been found to be true for a number of liquid-solid systems *(22)*. A linear relationship exists between the logarithms of the absolute viscosities of viscous mixtures made from a given liquid and a particular powder and the volume per cent of solid present, or

$$\text{viscosity (poises)} = C\,10^{AF} \qquad (3)$$

where F = volume per cent of solid and A and C are constants.

Fig. 2 which is taken from the paper mentioned above *(22)* shows how well Eq. (3) applies for different mineral powders. These minerals and the others studied are of interest to the bituminous engineer but those useful to the paper manufacturer should behave similarly.

The slope A of Eq. (3) offers a simple method of evaluating the ability of a solid to increase the resistance of a liquid to flow. A stability index has been proposed *(22)* which expresses the per cent change in viscosity for a one per cent increase in the volume of the solid present in the suspension. This quantitative index may be expressed as

$$\text{Stability Index} = 100\,(10^{A} - 1) \qquad (4)$$

$$= 100\,(\text{anti-logarithm } A - 1) \qquad (5)$$

where A is the slope of the log-viscosity versus volume composition curve.

Table II gives the stability indices for several powders including those shown in Fig. 2. Certain of the physical properties of these powders which influence the stability index have been evaluated also and are recorded in Table II.

**Table II.—Stability Indices and Physical Properties of Various Powders**

| Mineral Powder | Stability index (eq. 4) | Surface mean diameter (microns) | Specific surface ($cm^2/g.$) | Per cent voids by dry compaction | Particle shape |
|---|---|---|---|---|---|
| Limestone | 4.5 | 6.2 | 3,430 | 38.0 | Granular |
| Clay | 6.6 | 3.1 | 7,300 | 69.4 | Plate-like |
| Black slate | 6.6 | 4.1 | 5,120 | 57.6 | Granular and acicular |
| Green mica | 9.8 | 9.2 | 2,250 | 68.9 | Plate-like |
| Diatomaceous earth | 15.0 | 7.5 | 3,670 | 81.1 | Irregular |

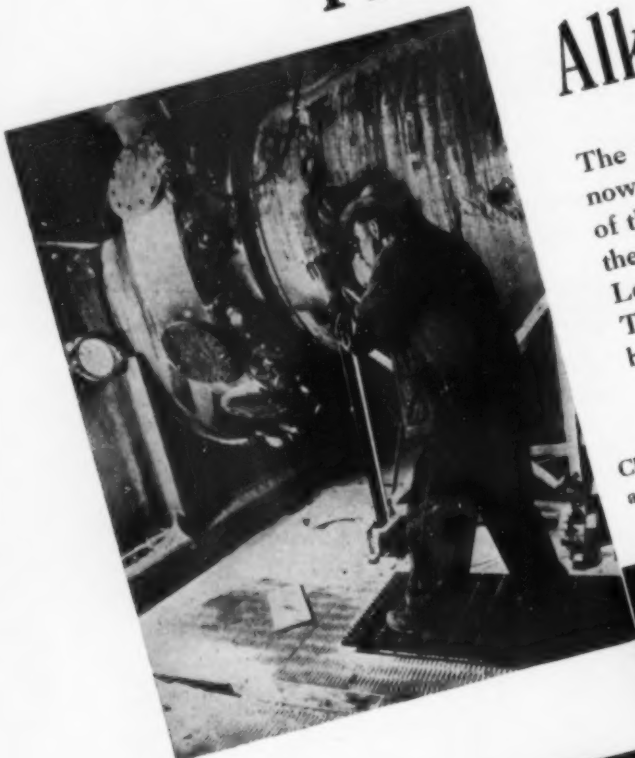
The stability index accounts for the combined effects of particle size, size distribution, shape and the degree to which the solid is dispersed. This last variable is important and it may be safely predicted that the accurate control of the degree of dispersion will be of great service to the paper manufacturer.

### References


(1) First Report on Viscosity and Plasticity prepared by the Committee for the Study of Viscosity. Academy of Science at Amsterdam. Uitgave van de N. V. Noord-Hollandische Uitgevers-Maatschappij, Amsterdam (1935).
(2) Hobson, G. D. *J. Institution of Petroleum Technologists* 21, 204-20 (1935).
(3) Broome, D. C. and A. R. Thomas. *J. Soc. Chem. Ind.* 50 424-T-428T (1931).
(4) Gamble, D. L. *Ind. & Eng. Chem.* 28, 1204-1210 (1936).
(5) Work, L. T. *Proc. Amer. Soc. Testing Materials* 28, II 771-812 (1928).
(6) Roller, P. S. U. S. Bureau of Mines Technical Paper No. 490 (1931).
(7) Roller, P. S. *Anal. Ed. Ind. & Eng. Chem.* 3, 212-216 (1931).
(8) Odén, S. *Soil Science* 19, 1-33 (1925).
(9) Bouyoucos, G. J. *Soil Science* 26, 233-8 (1928).
(10) Wagner, L. A. *Proc. Amer. Soc. Testing Materials* 33, II 553-570 (1933).
(11) Traxler, R. N. and L. A. H. Baum. *Proc. Amer. Soc. Testing Materials* 35, II, 457-71 (1935).
(12) Hauser, E. A. and C. E. Reed. *J. Phy. Chem.* 40: 1169-1182 (1936).
(13) Marshall, C. E. *J. Soc. Chem. Ind.* 50, 444-50T and 457-62T (1931).
(14) Perrott, G. St. J. and S. P. Kinney. *J. Amer. Ceramic Soc.* 6, 417-39 (1923).
(15) Green, H. *J. Franklin Institute* 204, 713-29 (1927).
(16) Hatch, T. *J. Franklin Institute* 215, 27-38 (1933).
(17) Heywood, H. *Proc. Inst. Mech. Engineers (England)* 125, 383-459 (1933).
(18) Norton, F. H. and F. B. Hodgdon. *J. Amer. Ceramic Soc.* 15, 191-205 (1932).
(19) Traxler, R. N., and L. A. H. Baum and C. U. Pittman. *Anal. Ed. Ind. Eng. Chem.* 5, 165-168 (1933).
(20) Roller, P. S. *Ind. & Eng. Chem.* 22, 1206-1208 (1930).
(21) Traxler, R. N. and L. A. H. Baum. *Physics* 7, 9-14 (1936).
(22) Traxler, R. N., H. E. Schweyer and L. R. Moffatt. To be published in *Ind. & Eng. Chem.* during 1937.

# Producing Alkalis for the South

The alkali requirements of Southern industry are now supplied by Southern plants. Views in two of the plants are shown here. On this page appears the Virginia plant and on the opposite page the Louisiana plant of the Mathieson Alkali Works. The latter is one of three such plants constructed by different companies in the Deep South recently.



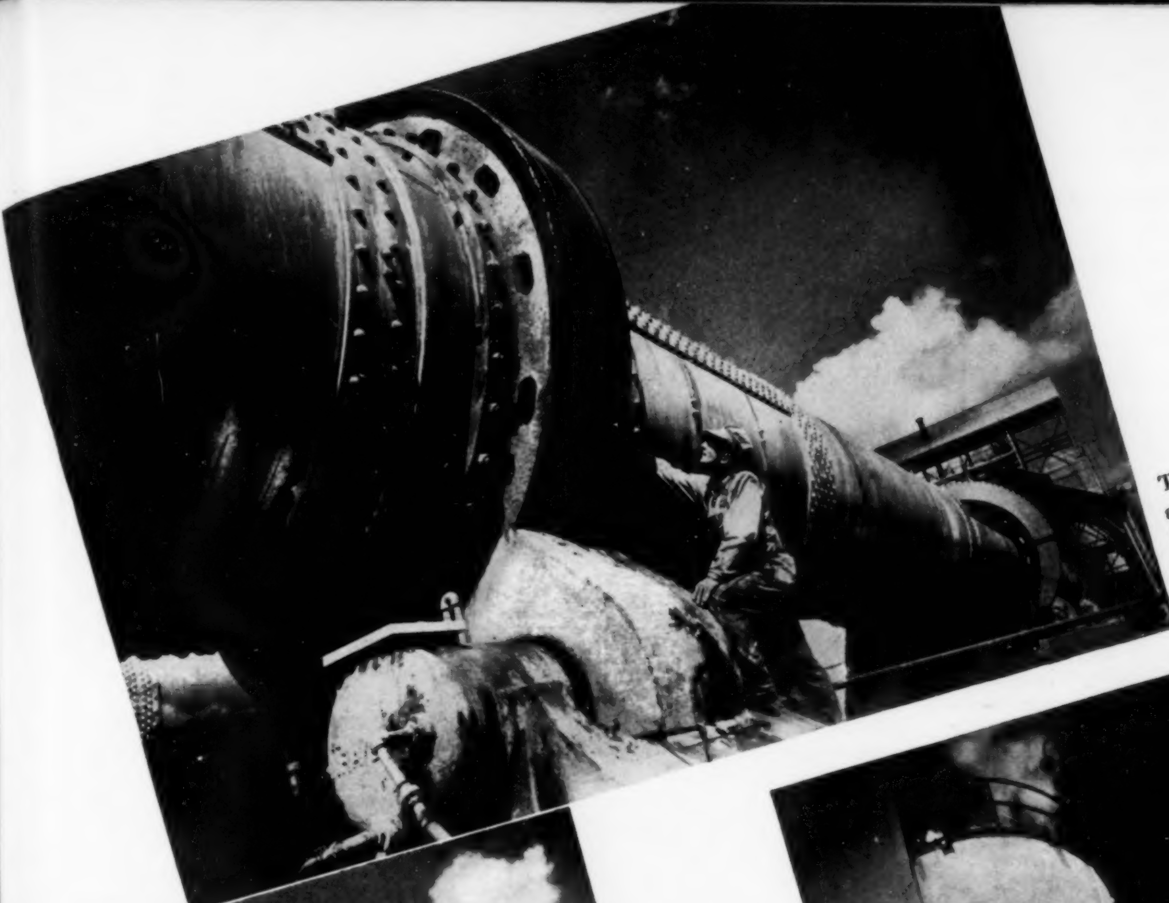
Checking temperatures in a rotary kiln with an optical pyrometer

Filling and weighing solid caustic soda drums. The operator on the right raises and lowers the spout by means of a lever

Bagging 58 per cent light soda ash in the Saltville, Va., plant of Mathieson Alkali Works

The Saltville, Va., plant of the Mathieson Alkali Works

Photos by Robert Yarnall Richie



These two lime kilns are 380 ft. in length. The lime plant can be seen on the extreme right

Oyster shells are used as the source of lime. They are plentiful on the Gulf Coast. A coal pulverizing plant and the lime plant stack are in the background

Lime slurry is stored in the tanks on the left. The lime slaker is in the background

On the left is the causticizing building. Notice the open construction of the plant

EDITORIAL STAFF REPORT

# CERAMISTS
## Foregather in New York

MARCH 21-27 saw the assembly and completion of the 39th annual convention of the American Ceramic Society, which was held at the Waldorf-Astoria Hotel in New York. After a day given over to general sessions the society's eight divisions occupied themselves for the following $2\frac{1}{2}$ days with separate technical programs adapted to their respective requirements. Finally, inspection trips completed a convention week which in the opinion of the visiting ceramists was among the most successful held by the society.

New officers chosen by the society and installed at the meeting included: president, R. B. Sosman; vice-president, V. Kelly; treasurer, C. F. Tefft; general secretary, Ross C. Purdy; new trustees, C. E. Bales, L. E. Barringer, and H. G. Wolframe.

An outstanding feature of the first day's general session was the presentation of a group of papers by R. E. Gould and his associates of the Tennessee Valley Authority ceramic laboratory staff. These were, in effect, a progress report recording the main results of this organization's ceramic work up to the end of 1936. It is planned to present the work of 1937 at the next Ceramic Society meeting in the form of a second progress report. The progress on problems connected with high temperature electric heating, which represent about 60 per cent of the laboratory work, was not taken up at this meeting except in discussion.

The papers presented included (1) the occurrence, refining, and uses of primary kaolins occurring in North Carolina; (2) the compounding of some special type ceramic bodies using this kaolin as the principal plastic constituent in order to give this material a severe test; (3) problems occurring in casting bodies made from the North Carolina materials, and their solutions; (4) accomplishments to date in plastic forming the material into various types of thin vitreous dinnerware shapes; and (5) some experimental firing schedules for various types of vitreous dinnerware in electric furnaces, going to comparatively high temperatures and using controlled atmospheres in the latter part of the operation.

The primary kaolins of North Carolina have some unique properties, chief of which is their extreme purity and practical freedom from titanium and iron. These properties have been known for many years, but because of the lack of plasticity of the material, as then marketed, and the general fear throughout the ceramic industry that insufficient material existed, no extensive work had been done, and the primary kaolins so necessary in the manufacture of vitreous whiteware were practically all imported from England. The work carried on by the T.V.A. laboratory in cooperation with state and government agencies showed that there is sufficient material to last for many years and that by a slightly better method of refining which has good commercial possibilities, an excellent product of high quality and uniformity can be made. The rest of the work was presented as proof that this kaolin can be used in making ceramic bodies by the plastic forming and casting methods and that these bodies can be fired apparently quite successfully by means of electricity.

The use of the electric kiln with controlled atmospheres appears to have one very important and interesting feature, namely, that in working with vitreous bodies the firing range after complete vitrification has been reached is enormously increased, thereby showing distinct possibilities in this method of firing for many types of ware.

Another general session, in which several divisions cooperated, was given over to ceramic drying. A survey of the past several years' progress in drying was presented by J. L. Carruthers. W. R. Morgan and R. K. Hursh discussed both the unsatisfactory results attained in applying recent methods in drying calculations to clay, and the comparative drying results attained with normal and de-aired clays. J. M. McKinley and R. R. Robinson presented a paper describing an investigation of a waste heat dryer for firebrick, showing how lower power costs, less loss of ware and more rapid drying were attained. Hewitt Wilson and K. G. Skinner presented equations and charts whereby the heat and air requirements of both continuous and periodic dryers can be determined.

More than 150 papers was presented on the programs of the several industrial divisions. Among them should be mentioned a paper by M. E. Manson dealing with the grinding of dry process enamels and the effect of fineness and moisture content on the working properties. The relatively new radiant tube furnace for enameling was described by W. O. Owen. A symposium of eight papers went thoroughly into the question of enamel defects. New information on the properties and uses of the new glass textiles was given by Games Slayter. Materials for use in ceramics brought out a considerable number of papers, among them one on the preparation of colloidal mineral colors, by P. M. Travis; another on the history and ceramic industry uses of colloidal graphite, by Raymond Szymanowitz and B. H. Porter; a third covering the ceramic uses of bentonite clay, prepared by Paul Bechtner. The new process employed by the Harris Clay Co. of Spruce Pine, N. C., whereby this concern's output has become of real ceramic importance, was detailed by J. R. Grout, Jr.

Included in the refractory program was an extensive symposium on refractory testing. Also presented by this division was a group of papers on special refractory materials, covering such subjects as fused silica, silicon carbide, fused alumina, fused magnesia and fused mullite.

De-airing of heavy clay products again came in for attention. Some of the problems which this practice has brought to the fore, and their solution, were discussed by J. H. Isenhour. The difficulties of continuous filtering in the production of dry-pressed porcelain and the comparative economies of batch and continuous filtering were taken up by G. G. Kent and E. M. Rupp.

# BULK PACKAGING CONFERENCE HELD BY A.M.A.

**PACKAGING is not new to the American Management Association, but prior to this year the "bulk package" had never come in for much attention. However, the Association found that considerable good could be gained by bringing together all those interested in this type of package, the users, the producers and the automatic filling equipment manufacturers. One entire day of the recent Seventh Annual Conference and Exposition in New York was devoted to bulk packaging. In the morning the problems met with in the use and transportation of drums were discussed, and in the afternoon the construction, handling and shipping of bags, as well as the automatic filling, weighing and closing equipment, came in for their share of attention.**

## Assistance for the Production Manager

*By R. W. LAHEY*
AMERICAN CYANAMID CO.
NEW YORK, N. Y.

THE contradictory term bulk packaging is used for want of a better name for the subject. It has to do with shipping containers such as bags, barrels and drums which are used for transporting large unit quantities. It also treats with the filling and closing of these containers—the handling, storing and transportation of them.

There are vast quantities of products shipped in these containers. *Chem. & Met.* has estimated that there are 550 million dollars worth of materials packed in returnable drums, 100 million dollars worth packed in non-returnable drums and 600 million dollars worth in bags for the process industry alone. Lest I bore you with too many statistics, I will give you only a few of the high spots.

The basic reason behind this program is the desire to start a movement towards the compilation and distribution of technical data on containers, their packing, handling and transportation. The entire lack of anything of this sort is a great handicap to all shippers. As the situation now stands information can be obtained only from competitive container and equipment salesmen, making it a matter of chance that the user contact the manufacturer of the container or equipment best adapted for his purpose.

It is possible to acquire this knowledge by visits to factories where they are made or used, by testing all different types and by making a study of transportation abuses. That of course necessitates time and expense, but there are some men in this room who have done just that. It has paid their companies real dividends.

The responsibility for choosing containers is usually placed on the shoulders of the factory manager. He has so many more important duties that he has not enough time to make the necessary investigations. Container, packing and shipping costs vary from 2 to over 25 per cent of the total. With this large amount of money involved it seems highly desirable that steps be taken to start the gathering and distribution of these data.

The program that will be offered you today has been difficult to construct. There are so many important subjects that could be profitably covered that we had to pick only a few.

Throughout the many discussions there have been many suggestions and it has been repeated several times that this activity take some permanent form—that it should not be dropped until the next Packaging Conference. We have had suggestions of monthly meetings, that a permanent association be formed. This has all been held in abeyance awaiting the outcome of this conference. The desirability and interest expressed here today will guide us in the next step to be taken. You will receive cards to fill out. The only purpose of this is to get a record of names and addresses for use in case it is considered desirable to go further with the subject.

## Plan for Simplification of Specifications

*By H. A. CAMPBELL*
ASSISTANT CHIEF INSPECTOR
BUREAU OF EXPLOSIVES, NEW YORK, N. Y.

CONTAINER specifications for explosives and other dangerous articles have long been a source of great difficulty to shippers and manufacturers of dangerous articles, and to the Bureau of Explosives. Such specifications originally were simple but as developments in the various manufacturing industries have progressed so has the manufacture of containers. The producers of containers have been called upon to develop better, lighter and cheaper containers. This continuous effort to meet changing economic conditions has brought forth the voluminous and intricate specifications that now exist due to the continuous amendments to the original specifications as necessitated by the developments of industry.

The shipper and the carrier,

whether a railroad, steamship, trucking or aeroplane transportation unit are only interested, in so far as our discussion at this moment is concerned, in the ability of a container to safely and adequately carry its contents to destination. Therefore, why not predicate the requirements of the container on its serviceability to withstand the conditions it will encounter in transit and make such tests of the particular container and its contents or a substitute thereof to prove its capabilities for the intended service.

I have advocated for some time a simplification of specifications for shipping containers so that they may be more readily understood and in order to avoid the continuous necessity for amendment or alteration. This plan will permit originators of ideas to produce different types of packages. It will also permit them to utilize the containers which they design if they will adequately withstand the shocks incident to transportation and are equally as efficient for transportation as the present prescribed containers the principles for which have been established by experience.

It is my thought, and I assure you that my associates in the Bureau of Explosives are in accord with it, that instead of writing specifications detailing thickness of metal, thickness of head sheet, design of spuds, number of threads on a plug, type of rolling hoops, etc., for a metal barrel or drum, that some simple tests could be devised which would adequately determine whether the metal drum in question would fulfill the requirements and purposes as laid down for drums under the present specification requirements. That is, if a metal drum, when filled with the commodity it is to carry or a substitute therefor, would withstand a drop test from a given height on its chime, its head or its side, would pass a hydrostatic pressure test of a given number of pounds and would withstand impacts which would approximate those which it would receive in transportation, that it would be classified as a drum acceptable for the shipment of hazardous articles. It could be thus marked.

Or, on the other hand, if instead of prescribing the number of A and B flutes in a piece of fiberboard, the mullen test for the board, the combined board, the double-wall board, the double-faced or solid board, the methods of closure, the meeting of flaps, the construction of partitions, the method of sealing, the kind of tape or stitching that may be required, etc., that we merely prescribe for fiberboard boxes requirements that the box shall pass some specified simple tests, i.e. compression, impact, and drop tests. It would then not make any difference whether the package was made of this board or of that board, or was folded in this manner or that manner, or whether the flanges met at the center or at the edge. All of the individual items which are so numerous and cumbersome would be eliminated. The question of type and design of box would be left to the ideas and development of the individual box manufacturer, or perhaps the box manufacturer and the shipper of the commodity. When, therefore, under this type of regulation new packages are designed or new types developed the necessity for amending and supplementing the regulations would not exist. It would not be necessary to withhold production until the Interstate Commerce Commission had issued necessary amendments. The packages could be used immediately and the tests could be conducted rapidly and readily. The same discussion, of course, will apply to wooden barrels, kegs, plywood drums and bags.

The same principles as I have outlined for fiberboard boxes could be readily adapted for tests of wooden boxes.

You will see, therefore, that while these specifications are developed and written in the language of the particular type of container industry concerned with it and approved by that industry, the members of the industry are, on many occasions, not able to interpret the specifications.

While we have not as yet acquainted the various container associations with the plan of simplification as I have outlined to you it has been discussed informally with some few representatives of the industries concerned. It has thus far met with hearty approval.

I have placed before you the difficulties in which the manufacturer of a product, the container producer and the Bureau of Explosives find themselves today. I have attempted to bring to your attention that which I consider a simple solution. My case is completed, the answer rests with you.

# Current Problems in the Use of Drums

A ROUND-TABLE DISCUSSION

A UNIQUE FEATURE of the first Bulk Packaging Conference was a symposium or round-table discussion conducted by Ralph H. Everett. secretary of the Keystone Varnish Co. of Brooklyn, N. Y. Ten basic problems involved in the use and transportation of shipping drums had been carefully outlined by Mr. Lahey's committee and discussions from the floor were led by Norman Babcock, Carbide & Carbon Chemicals Corporation, J. C. Wiesel, Hercules Powder Co., G. K. Herzog, of the Electro-Metallurgical Co., C. W. Clark, D. G. Stewart and M. F. Crass of E. I. du Pont de Nemours & Co., Thomas P. Callahan of Monsanto Chemical Co., E. D. Thompson of Stevens Metal Products Co., H. W. Lees of Draper Manufacturing Co. and Thomas Thompson of Chas. Pfizer & Co. Complete transcripts of all discussions will be available later through the American Management Association, but the following notes indicate the trend of interests represented at this conference.

*Problem 1. How to keep track of returnable containers with particular reference to a simple system of marking and cost accounting. What relation should the cost of returnable containers bear to the total cost of the delivered product?*

Carbide & Carbon Chemicals Corp. uses returnable containers principally for its acetic anhydride and corrosive products that might otherwise be contaminated. Former practice, according to Mr. Babcock, was to give each drum a serial number which was recorded with all pertinent information including record of each shipment on a card file kept in the sales offices. With the advent of acceptable single-trip drums, however, it was no longer economical to maintain such an elaborate bookkeeping system. Drums are now charged to a returnable container account payable within 60 days.

Mr. Wiesel of Hercules reported that if returnables are billed on memorandum invoice it usually takes too long to get them back to the manufacturer. Too many customers

like to keep them for use as convenient storage of raw materials. Others occasionally fail to prepay the freight on returns, thus further complicating the bookkeeping.

How long will a returnable drum last? Mr. Babcock had spoken of depreciation over a three-year period, but Mr. Callahan of Monsanto and Mr. Crass of du Pont, reported experience extending from five to ten years—even 20 years life was indicated in the case of stainless steel drums. Mr. Callahan stated that the larger chemical manufacturers kept a careful check on their returnable drums by weighing them periodically, making the necessary repairs and retiring them when weight had reached a certain minimum. Other speakers also stressed the importance of testing returnable containers to make certain that safety precautions are observed. The practice of some chemical manufacturers in using a returnable drum just as long as it would hold together was condemned as an unnecessary and undesirable hazard. Several shippers deplored the recent increase in the cost of one-time drums and indicated that this would doubtless lead to increased use of returnables.

*Problem 2. Selecting the proper type of stainless steel to be used for handling different chemicals and food products which cannot stand contamination.*

G. K. Herzog of the Electro-Metallurgical Co. pointed out that in general stainless steels are available for handling nearly any liquid shipped in commerce. They are readily cleaned and sterilized and have other advantages especially for the shipper of chemicals and food products. The ordinary 18-8 alloy is about as satisfactory as any for average use especially because it can be drawn or fabricated more readily than other chromium-nickel alloys. Where corrosive requirements are particularly severe, as in the case of glacial acetic acid, acetic anhydride and chemically pure phosphoric acid, a stainless steel containing some molybdenum has important advantages. Where welding or heat treatment offer difficulties, it is common practice to use stabilized stainless steels containing small amounts of columbium or titanium to prevent inter-granular crystallization.

Several shippers asked about the possibility of cheaper alloys but Mr. Herzog explained that the principal cost was in fabrication rather than in the alloying elements. He suggested the use of stainless-clad steels as one of the answers to this problem.

***Problem 3. What coatings are available for metal drums which will protect the contents from contamination?***

For heavy drums, according to C. W. Clark of du Pont, various metallic coatings are entirely satisfactory. For light drums, however, the problem is much more difficult. Galvanizing is often practical, but increases the cost. Many of the newer synthetic materials will not withstand turpentine and in general, most air-dried products are not very satisfactory. Baked-on coatings, applied at temperatures from 200 to 600 deg. F. for 20 min. to an hour are generally much better. Thermoplastic coatings, applied on a lacquer base, were reported satisfactory for zinc-chloride and other corrosive solutions. Chairman Everett emphasized the need for adequate testing as well as thorough cleansing of the metal and care in applying the coating.

*Problem 4. How can decorated drums be loaded in box-cars to eliminate stuffing while in transit?*

T. P. Callahan, whose active interest and discussion of all the problems did much to make this symposium a success, reviewed the methods used by manufacturers to prevent the marring of decorated drums—too often caused by careless handling by the railroad. Some shippers use paper between the drums; others put a whole paper stocking over the drums, some use lumber and lumber and paper over the head.

*Problem 5. What is the best method of loading one-time shippers in car-load lots?*

Mr. Callahan, in answering this question, stressed the importance of standardization of size, both as regards containers and box-cars used. He referred to the work done by the Manufacturing Chemists' Association, through its various technical committees which have standardized procedures for loading carboys and certain other shipping containers. His company has found it most satisfactory to insist that box-cars containing carboys should be shipped with the doors securely fastened open so as to reveal the nature of their contents.

*Problem 6. Discussion of the use of three as compared with five threads in plugs for returnable drums.*

Maurice F. Crass of du Pont declared that both the welded and mechanically seated flanges in drums have their fields of usefulness, but the customer should be protected against the over-zealous advocates of either procedure. In general the welded flange is most satisfactory for returnable drums while the pressed-in flanges are satisfactory for one-time shippers where there is less danger of corrosive attack on gaskets and fillers.

A test on the three-thread type of plug showed satisfactory performance for non-returnable containers, but the five-thread plug is preferred for returnables.

*Problem 7. Standardization of plugs. Would standard plugs eliminate the various types of wrenches and technique required today in opening drums?*

Harry W. Lees of the Draper Mfg. Co. stated that size is gradually being standardized, but there are still odd shapes and types of plugs that require different kinds of wrenches and tools for their removal. It would be a real improvement to standardize on the use of but one type. Mr. Everett recommended that the procedure followed by the paint industry in its simplification work with the U. S. Department of Commerce, might well be followed by the drum manufacturers.

*Problem 8. The development of drums which will prevent distortion of rolling hoops.*

According to E. D. Thompson of Stevens Metal Products Co., drum manufacturers have improved design and production methods to give a standard straight-rolled hoop of greater strength than the expanded hoop. Some manufacturers reroll their hoops, thereby broadening them. By corrugating the shell between the hoops and the chimes, additional strength can be obtained.

*Problem 9. Which ring closures on open-head drums are most efficient?*

Chase Bennett of Wilson & Bennett, stated that those rings which have a sufficient take-up to secure a tight fit of the ring were most satisfactory no matter what the design. Ring closures for open-head drums which make use of an auxiliary nut for adjustment are quite satisfactory. Mr. Everett pointed out that in the experience of the paint industry the open-head container has a tremendous advantage because it helps the user to make certain that he gets a uniform mixture of pigment and vehicle.

*Problem 10. Will fiber drums prevent the contamination of powders or granular material? Can liquids or semi-liquids be shipped in fiber drums?*

Thomas Thompson of Charles Pfizer & Co. reported that his company uses large numbers of fiber drums for the shipment of dry pharmaceutical products requiring maximum protection against contamination. They must guard against contamination from moisture as well as particles of glue, fiber, wood, nails, rust and other extraneous matter. A ply of moisture resisting material, such as asphalt, cellulose acetate or aluminum foil, greatly reduces vapor loss. Greases, pastes and other semi-liquids are being satisfactorily shipped in fiber containers but as yet the use of large fiber drums for liquids awaits the development of impervious materials of greater strength.

## Bags Have Their Advantages

### A SYMPOSIUM

BAGS were the principal subject of the afternoon session. Their construction and classification were discussed by T. E. Milliman, vice-president of Cooperative G.L.F. Soil Building Service, Inc., New York, N. Y. He stated that bag manufacturers are now able to offer almost any degree of protection desired, whether it be from air, acid, dust, oil, moisture, odors, or vermin.

The present trend in the size of packages is toward 100 lb. or smaller which can be handled easily, quickly and efficiently. Packages of these sizes offer wider markets of distribution and quicker consumption, reducing the likelihood of deterioration, spoilage and waste of contents.

Burlap fabric was first imported from India into this country in volume shortly before the turn of the century. In 1936 our importations from Europe and India were somewhere in the neighborhood of eight hundred and seventy-million yards. Due to extreme low cost of labor in India, the fabric can be produced and landed here, under the present United States import duty of 1c. per lb. at considerably lower than the cost of competing cotton cloth from our domestic mills.

Through research, improved equipment and increased efficiency, great strides have been made in standardization, consistency of quality and finish of cotton bags. The seamless bags are woven in the cotton mills. They are designed for multiple-trip or heavy duty service.

The introduction of crinkled paper lining has given impetus to the acceptance of the textile bag as a real competitor to rigid containers. Materials that heretofore had been too free-running and prone to sift for shipment in bags, can now be packed in this comparatively new and inexpensive package.

The use of paper linings made it possible to ship in textile bags materials that had been subject to contamination by foreign matter and outside odors. It was also found that paper linings kept some materials free from jute and cotton lint. Shippers of powdered, pulverized and granular materials were quick to grasp the possibilities of the paper lining and its growing use followed.

It is only a little more than a decade ago that the multi-wall bag made its appearance on the market. Today, the greater part of the world's cement output and virtually all hydrated lime and gypsum plaster produced are packed in bags of this type. It is extensively used also for certain pulverized and granular chemicals and for foodstuffs such as sugar, flour and salt.

During the discussion of this paper it was again emphasized, this time by Mr. Cook of Procter and Gamble, that 100 lb. was the maximum weight of material that could be satisfactorily carried in a multi-wall paper bag. Paper bag manufacturers discourage the use of larger amounts. There would be no advantage from a cost standpoint in loading more material into a bag, and besides customers want the light-weight bags as they are more easily handled.

George Webber of Standard Brands, Incorporated, discussed reconditioning of bags damaged in transit. In most cases the damage is due to punctures. His company makes a practice of sending a bulletin to agents and warehouse men which explains the repairing of punctured bags. In addition several empty bags accompany each shipment.

Packing, weighing and bag closing equipment was discussed by H. H. Leonard, president of the Package Machinery Institute. The basic requirement in any packaging process is the provision of sufficient storage capacity to absorb the fluctuations that come in both the packaging and the manufacturing processes. Seldom is there a packaging process so efficient that there is not an occasional stoppage, and without sufficient storage capacity back of it a serious situation may develop in the manfacturing process. Likewise the variation in the rate of flow from the manufacturing process will alter the amount of material in storage for the packaging process.

Probably no one thing is more essential to the success of the packaging process than a properly designed storage tank, and too frequently little intelligent consideration is given to this matter. If we think of the material in the tank as always being in motion we immediately realize the necessity of providing a construction for the tank which would not only be sufficiently strong to hold the desired amount of material but would have no projecting corners or other obstructions to interfere with the flow.

There is no one thing affecting the packaging of free flowing materials that is more important than to so design the connection between the storage bin and the packaging machine that, regardless of the amount of material or as it is commonly called "head load" in the bin, the flow to the packaging machine will be uniform at all times. With free flowing materials this can usually be accomplished by a well designed connection at the proper angle leading from the bin to the intake of the packaging machine. Sometimes the flow can be controlled by baffles or the like in this connecting pipe.

The handling and shipping of bags was the subject of a paper by E. L. Chase, production manager of Cooperative G.L.F. Mills, Inc. As he stated, this problem varies with the size of the business. In the discussion of this paper Mr. Callahan and other speakers brought out the fact that shippers experience much trouble due to the bad condition in which the freight cars are delivered at the plant. The shipper must clean the car, remove nails, and other obstructions, and cover the rough floor with heavy paper. In fact, the railroads show so little interest in cooperating with the shippers that much business is going to the trucking organizations that formerly went to the railroads.

Chemical Engineer's BOOKSHELF

# Absorption Theory and Practice

Absorption and Extraction. By *Thomas K. Sherwood.* Published by the McGraw-Hill Book Co., New York City. 263 pages. Price, $3.50.

Reviewed by *E. M. Baker*

THE AUTHOR correctly describes the content of this book in his preface as follows: "The book may be divided roughly into three parts: the theoretical aspects of diffusion and the underlying theory of the design of absorption equipment; a summary of the available performance data on various types of equipment; and a section dealing with the basic principles of solvent extraction. The first presents the important relations derived from the kinetic theory and explains their applicability to the interphase transfer of materials. Graphical methods for design calculations are treated in detail, and a chapter is devoted to the design of absorption equipment for multicomponent systems, so important in the petroleum industry. The latter includes tables of previously unpublished equilibrium data derived from the Lewis fugacity charts. The two chapters on absorption equipment include brief descriptions of the principal types, as well as the physical characteristics, allowable gas and liquor rates, and pressure-drop data for the more important packing materials. Absorption coefficients for the various systems have been collected from various sources and are summarized and presented in a single standard set of units. The final chapter deals with the underlying principles of solvent extraction, and explains the general methods of calculation employed both for three-component systems and for the solvent refining of lubricating oils."

Professor Sherwood has presented the theoretical side of the subject matter rigorously, and in manner that is clear and readily followed. Illustrative examples have been used freely throughout, and should prove most helpful to the average user of this text.

Less than 10 per cent of the book is devoted to "Extraction." This material is substantially restricted to solvent extraction and the Hunter-Nash method of calculating equilibria for a ternary system. Leaching and washing are dismissed in a single paragraph referring to literature references on these subjects. However, the subject of absorption is treated comprehensively.

The reviewer feels that Professor Sherwood is to be congratulated on this work, which is suitable for use as a text in advanced chemical engineering courses dealing with absorption. It should also prove most valuable to the chemical engineer in industry.

### Who's Who and Why

The Chemical Who's Who, Vol. II, 1937. Edited by Williams Haynes. Published by the Haynes & George Co., New Haven, Conn. 543 pages. Price, $6.

Reviewed by *S. D. Kirkpatrick*

BEST evidence of the usefulness of this "Chemical Who's Who" is that one after another of two copies of the 1928 edition disappeared from my bookshelf and were never returned. Some one has suggested a ring and chain as a handy accessory for guarding this more valuable edition which contains 5686 biographies as against 3982 in its predecessor. Interesting and amusing, if not so valuable, are the statistics on hobbies and college degrees. Golf and Columbia lead in their respective lists. More useful is a geographical index and a classification by companies.

Despite the 40 per cent increase in number of biographies there are still many notable omissions. Only four names are shown for General Chemical Co. while there are nine from Florida University. Time and subsequent editions may correct the few minor errors discovered by this reviewer, such for example as the crediting him with an extra son.

### Uncle Sam, Publisher

Government Publications and Their Use. By *L. F. Schmeckebier.* Published by the Brookings Institution, Washington, D. C. 446 pages. Price, $3.

Reviewed by *R. S. McBride*

ANY ENGINEER or executive who undertakes to keep in touch with government documents as an aid to his industrial work knows the complexity of Uncle Sam's publishing methods. A few such members of process-engineering organizations will find the present volume an invaluable guide in procuring and using official literature.

Librarians will welcome this volume as one of the best guide books of documents which has ever been prepared. It far exceeds in scope and attractiveness any of the government's own attempts at description. Furthermore, the lawyers and administrative officials who have to keep track of federal administrative regulations, departmental rulings, executive orders, and other things of that kind, can well peruse this book as a guide to their efforts.

The book comes from the Brookings Institution. It is the work of a man who for many years as both hobby and business has kept in touch with diverse government activities as few others have been able to do. The result is an authoritative as well as readable and usable volume.

### Pulp Production Up-to-Date

Manufacture of Pulp and Paper, Vol. III. Preparation and Treatment of Wood Pulp, Third Edition. Edited by J. N. Stephenson. Published by the McGraw-Hill Book Co., New York City. 825 pages, 275 illustrations. Price, $6.50.

UNDER the direction of the Technical Association of the Pulp and Paper Industry and the Canadian Pulp and Paper Association, J. N. Stephenson and his group of pulp making authorities have brought up-to-date this manual dealing with the production of pulp. It is prepared to serve as a textbook for students and for mill engineers. It gives a thorough authoritative treatment of the production and treatment of wood pulp, covering the principles and operation of the various processes, the nature of the wood used, its preparation, equipment and methods of pulp making, screening and bleaching, testing of pulp and the like.

Due to the enormously important changes that have occurred in pulp making during the past decade since the last revision of this textbook, the authors found it necessary to revise completely the contents. The sections on soda pulp, sulphate pulp, bleaching of pulp, and testing of pulp have been entirely rewritten, and extensive changes and additions have been made in the other sections. This revision covers such salient

advances as: stacking wood, pressing and drying bark, grinding wood, screening pulp, recovery of heat and acid in sulphite cooking, the use of corrosion resistant metals and alloys, new furnaces for heat recovery in alkaline pulp mills—with an important division on heat balances, new refiners for recovery of pulp screenings, much new material on bleaching, additional matter on testing pulps of extra quality and for special purposes. Nearly 200 pages had to be added to adequately cover the many new subjects.

Directory of Members of the Association of Consulting Chemists and Chemical Engineers, Inc., Third Edition, November 1, 1936. Published by the Association at 50 East 41st St., New York City. 60 pages. Copies free upon request to the Association.

LISTS 55 of the leading chemical and chemical engineering consultants in the United States. In addition to the ordinary data expected, the directory contains full details of the scope and nature of the work which each consulting firm or individual is especially prepared to undertake. The present edition is the first to include this valuable supplementary information.

The Preservation of Iron and Steel by Means of Paint. By *L. A. Jordan* and *L. Whitby*. Published by the Research Association of British Paint, Colour and Varnish Manufacturers, Paint Research Station, Teddington, Middlesex, England. 68 pages. Price, 2s. 10d.

PRESENTED in this booklet is a discussion and classification of primer pigments for iron and steel, pigments for finishing coats, paint media, and effects of condition of metal surface and method of application on the durability of the paint.

Elementary Physical Chemistry. By *H. S. Taylor* and *H. A. Taylor*. Published by D. VanNostrand Co., New York City. 646 pages. Price, $3.75.
Reviewed by *W. L. Abramowitz*

AS CAN readily be seen from a perusal of the available texts, it is difficult to prepare an understandable exposition of modern physical chemistry. In this book the two Taylor brothers have collaborated to produce an excellent simplified condensate of the well-known *Treatise on Physical Chemistry*. The subject matter includes the atomic concept of matter, energy in chemical systems, mechanism of reaction, phase rule, ionic equilibria, and colloids. Research workers to whom physical chemistry is of definite interest but not a demanding specialty may prefer to own this volume rather than the more exhaustive and also considerably more expensive *Treatise*.

# GOVERNMENT PUBLICATIONS

*Documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington, D. C. Send cash or money order; stamps and personal checks not accepted. When no price is indicated pamphlet is free and should be ordered from bureau responsible for its issue.*

*Paint Tests.* Bureau of Standards mimeographed documents on: Inside wall paint for chemical laboratories (heat- and fume-resisting enamel paint), LC489; Aluminum paints, TIBM-43; Paint drying oils—linseed, TIBM-44.

*Inks,* by C. E. Waters. Bureau of Standards Circular 413; 10 cents.

*Performance Test of Floor Covering Materials.* Bureau of Standards Letter Circular 484; mimeographed.

*Sponge-Iron Experiments at Mococo,* by Chas. G. Maier. Bureau of Mines Bulletin 396; 15 cents.

*Carbonizing Properties and Petrographic Composition of Coals,* by A. C. Fieldner and others. Coals from Buchanan Mines Nos. 1 and 2, Buchanan County, Va., Bureau of Mines Tech. Paper 570; Pittsburgh Terminal No. 9 Mine, Washington County, Pa., Tech. Paper 571; Consolidation No. 155 Mine, Johnson County, Ky., and the Effect of Blending Millers Creek Coal with Pocahontas Bed and Pittsburgh Bed (Warden Mine) Coals, Tech. Paper 572; Lower Sunnyside Coal of Utah, Tech. Paper 573; 10 cents each.

*Analyses of New Mexico Coals,* by R. W. Ellis. Bureau of Mines Tech. Paper 569; 15 cents.

*Annual Report of the Explosives Division, Fiscal Year 1936,* by Wilbert J. Huff. Bureau of Mines Report of Investigations 3337; mimeographed.

*Ore-Dressing Studies,* by R. S. Dean and others. Bureau of Mines Report of Investigations 3333; mimeographed. Includes chapters on: Use of wetting agents in flotation; Flotation of complex molybdenum-vanadium ores from Mammoth, Ariz.; Short-column hydraulic elutriator for subsieve sizes.

*Ore-Testing Studies,* by W. F. Dietrich and others. Bureau of Mines Report of Investigations 3328; mimeographed. Includes chapters on: Ore-dressing tests and their significance; The analysis of molybdenum; Report of tests.

*Beneficiation of Spodumene by Decrepitation,* by Foster Fraas and Oliver C. Ralston. Bureau of Mines Report of Investigations 3336; mimeographed.

*Bureau of Mines Activities in the Field of Building Materials,* by D. M. Banks. Bureau of Mines Information Circular 6924; mimeographed.

*Deterioration of Book and Record Papers,* by T. D. Jarrell and others. Department of Agriculture Technical Bulletin 541; 5 cents.

*Forestry and Permanent Prosperity,* by R. F. Hammatt. Department of Agriculture Miscellaneous Publication 247; 5 cents. A resume of policies.

*Peat Land in the Pacific Coast States in Relation to Land and Water Resources,* by A. P. Dachnowski-Stokes. Department of Agriculture Miscellaneous Publication 248; 15 cents.

*Development and Significance of the Great Soil Groups of the United States,* by Charles E. Kellogg. Department of Agriculture Miscellaneous Publication 229; 25 cents.

*Neutralization Curves of the Colloids of Soils Representative of the Great Soil Groups,* by M. S. Anderson and H. G. Byers. Department of Agriculture Tech. Bull. 542; 10 cents.

*Selenium Occurrence in Certain Soils in the United States With a Discussion of Related Topics, Second Report,* by H. G. Byers. Department of Agriculture Technical Bulletin 530; 10 cents.

*Soybeans and Soybean Products for Table Use.* Department of Agriculture, Home Economics Bureau, unnumbered document; mimeographed.

*An Improved Apparatus for Mixing Insecticidal Dusts,* by Theo. E. Bronson. Bureau of Entomology and Plant Quarantine, ET-93; mimeographed.

*Textile Industries in the First Half of 1936.* Federal Trade Commission unnumbered documents; mimeographed. Part I, The Cotton Textile Industry, Including Thread, Cordage and Twine; Part III, The Silk and Rayon Textile Industry.

*International Trade in Goatskins,* No. 1, United States Imports and Reexports. Bureau of Foreign and Domestic Commerce, Supplement to Leather Raw Materials Bulletin; 10 cents, mimeographed.

*Some General References to Information on Cane and Beet Sugar.* Bureau of Foreign and Domestic Commerce, Foodstuffs Division; mimeographed.

*Review of Vegetable and Competing Oils for 1936,* by Charles E. Lund. Bureau of Foreign and Domestic Commerce, Foodstuffs Division; mimeographed.

*United States-Philippine Trade, With Special Reference to the Philippine Independence Act and Other Recent Legislation.* Tariff Commission Report No. 118, Second Series; 20 cents.

*Expansion of Japan's Foreign Trade and Industry, by V. P. Copping.* Bureau of Foreign and Domestic Commerce, Trade Information Bulletin 836; 10 cents.

*The Changing Character of American Exports to Brazil.* Bureau of Foreign and Domestic Commerce, Division of Regional Information, Special Circular No. 377; 5 cents, mimeographed.

*Statistical Classification of Imports into the United States.* Bureau of Foreign and Domestic Commerce, Schedule A; 35 cents. Gives also rates of duty and regulations governing the preparation of monthly and quarterly statements of import, effective January 1, 1937.

*The Fumigation of Vessels,* a Symposium, by C. L. Williams and others. Public Health Service Reprint 1518; 10 cents.

*The Home Medicine Cabinet.* Unnumbered pamphlet, Consumer's Project under supervision of U. S. Department of Labor.

*State Labor Laws for Women,* by Florence P. Smith. Department of Labor, Women's Bureau Bulletin 144; 15 cents.

*Occupational - Disease Legislation in the United States, 1936.* Bureau of Labor Statistics Bulletin 625; 10 cents.

*Federal Specifications.* New or revised specifications of the Federal Specification Board on: Cement, Portland, moderate-heat-of hardening, SS-C-206; Duck, Cotton, Enameled, CCC-D-741; Paper, Kraft, wrapping, waterproofed, UU-P-271; Paper, kraft, wrapping, paraffined, UU-P-270; 5 cents each.

*Statistical Abstract of the United States, 1936.* Department of Commerce, unnumbered document; $1.50 (Buckram), 840 pages. Summary of statistics showing trends in trade and industry.

*Oil and Gas Operating Regulations Applicable to Lands of the United States and to all Restricted Tribal and Allotted Indian Land (Except Osage Indian Reservation).* U. S. Geological Survey, unnumbered pamphlet, Revised November 1, 1936; 10 cents.

*Some Deep Wells Near the Atlantic Coast in Virginia and the Carolinas,* by W. C. Mansfield. U. S. Geological Survey Professional Paper 186-I; 5 cents.

*Pressure Drop in Tubing in Aircraft Instrument Installations,* by W. A. Wildhack. National Advisory Committee for Aeronautics Technical Notes 593.

*The Cetene Scale and the Induction Period Preceding the Spontaneous Ignition of Diesel Fuels in Bombs,* by M. N. Michailova and M. B. Neumann. National Advisory Committee for Aeronautics Technical Memorandums 813; mimeographed.

*Heat Transfer to Fuel Sprays Injected into Heated Gases,* by Robert F. Selden and Robert C. Spencer. National Advisory Committee for Aeronautics Report No. 580; 10 cents.

## Readers' VIEWS and COMMENTS

# Streams—To Use But Not Abuse

Editor's Note: The following letter refers to our March editorial in which it was pointed out that industry may well profit by prompt and intelligent action in the matter of industrial waste disposal. The "off with their heads" attitude, which is evidenced in some of the stream pollution regulatory bills now before Congress, might be curbed if industry would make a serious attempt to meet the problem fairly, and recognize that it has here a social as well as technical responsibility. Aptly stressed by Abel Wolman, chairman of the Water Resources Committee, is the point that "engineers, particularly in the industrial field, cannot afford to permit these questions to be settled entirely by the politicians." The chemical engineer cannot afford to chance regulatory legislation and drastic dicta which later may lead to extended control. The extent to which Federal and State laws are likely to go in this direction will depend largely on how promptly and intelligently industry acts in accepting its responsibility.

*To the Editor of Chem. & Met.:*

Sir:—This morning I read your editorial in the March number of *Chem. & Met.* and was much interested therein, particularly in your quotations from Mr. Wolman's address, and wish to commend your attitude.

It is very easy to say, "Off with their heads!" but I think little would be accomplished by such a course. As you know, Dr. Stevenson, chief engineer of the Pennsylvania Board of Health, has done as much as anyone in handling the stream pollution problem by cooperating peacefully with manufacturers and coal miners, and while progress may seem slow, it is being made in his State all of the time.

During the height of the depression, state authorities have been reluctant to proceed against manufacturers, even those grossly polluting streams, because of their financial disabilities. Recently a marked change has been noted, and in our office at this writing, we have four cases for manufacturers—two wool scouring and two bleachery waste problems.

I believe that our streams should be used but not abused, and if it is not practicable to restore the pristine purity of all streams, it is, however, practicable to keep all of them free from nuisance and to preserve most of them so that they can be used for a water supply—with purification—and for sewage and waste disposal with adequate treatment of the discharges of these fluids.

Robert Spurr Weston

Sanitary Engineer
Weston and Sampson
Boston, Mass.

**Early Rotary Filter**

*To the Editor of Chem. & Met.:*

Sir: I thought you might be interested to see a photostat of a sketch which I made on January 6, 1896. This is the original sketch of the first rotary filter which was designed by me on the above date.

A suggestion was made by Ernest Solvay that it might be possible to attract a crystal on the surface of the cylinder by putting a vacuum on the inside of it and revolving the cylinder so that the dried crystal could be scraped off. A small model was made and it was found that the cylinder would pick up the crystal and draw the liquid through it when a vacuum of about 10 in. of mercury was carried on the inside. The idea appealed to me and I made the enclosed sketch, constructed six machines at once and had to transfer a large number of men who had previously been used to shovel out the bicarbonate of soda from long vacuum filters consisting of a tank with a grate and flannel over the grate.

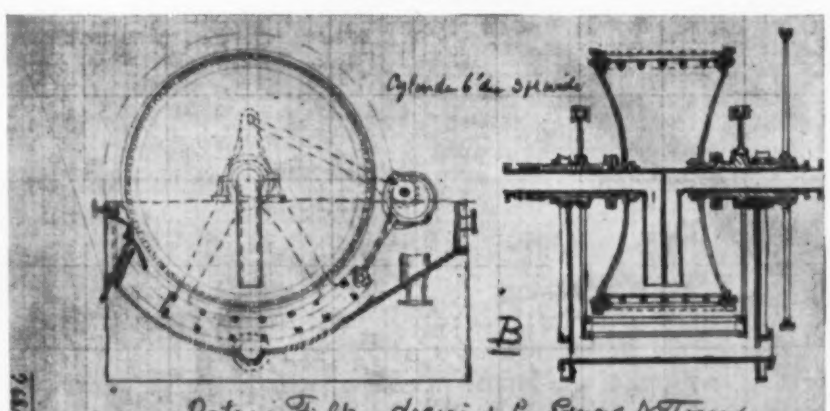
Two of the original machines were still in use in 1933. Improvements were afterwards made in these machines by putting in a back washing system which blew off the crystals every revolution. This eliminated the surface formed by the knife rubbing against the crystals. Another improvement was the connection of the knife to the oscillating stirrer which gave a very slight movement, making a corrugated surface which was so synchronized as to cut the surface in a different plane each revolution.

I thought you might be interested in this bit of history. As the use of these filters was kept very quiet for a good many years it took quite a while before the chemical trade got to using them, and the Oliver filter, which was afterwards developed on similar lines, is now in general use and has been very successful.

Edward N. Trump

Consulting Engineer
Syracuse, N. Y.

**Original sketch of the first rotary filter to be put in successful operation**



# PROCESS EQUIPMENT NEWS

REVIEW OF MACHINERY, MATERIALS AND PRODUCTS

### Barrel Packer

A new electric vibrating barrel packer of low head, and capacity up to 800 lb. gross, has been announced by the Jeffrey-Traylor Division of the Jeffrey Mfg. Co., Columbus, Ohio. The new vibrator stands only 16½ in. high, hence requiring a shallower pit than other similar units for floor level operation. Watertight installation can readily be made by the use of a rubber skirt.

### Circulating Oven

Five standard sizes of gas or electric heated ovens, with forced air circulation, for laboratory and small production work, have been announced by the Paul Maehler Co., 2216 West Lake St., Chicago, Ill. These ovens are made in sizes ranging from 3¾ to 20 cu.ft. inside volume and are so designed that by means of fan circulation of heated air, an even heat distribution within a range of 5 deg. F. is said to be maintained, eliminating hot or cold spots. Thermostatic control maintains temperature at any predetermined setting. Ample insulation reduces the radiation losses.

Operation is briefly as follows: Heated air drawn upward from the combustion chamber through side ducts into a fan is then forced downward through a distribution screen into the oven. Uniformity of temperatures up to 500 deg. F. is thus said to be assured.

Low-head vibrating barrel packer

### Automatic Digger

For the handling of dry chemicals from storage piles, stock bins, box cars, and so on, the George Haiss Mfg. Co., 391 Canal Place, New York City, has developed a new automatic digger and unloader. The machine is essentially a self-feeding, portable bucket loader discharging on to the loading end of a portable conveyor. It has been made small enough to pass through a box car door, and hence can work in practically any storage space. It digs through the action of a series of paddles which act like a screw conveyor in passing the material from each side into the buckets of the elevator. The paddles also have a pick action by which they break up large lumps or caked material.

The loader is self-propelling in both directions, has a rated capacity of 2 cu. yd. per min. and is powered with an electric motor which, for corrosive conditions, is of the fully inclosed type.

**Right: Portable digger and unloader for dry chemicals**

**Laboratory and small production oven**

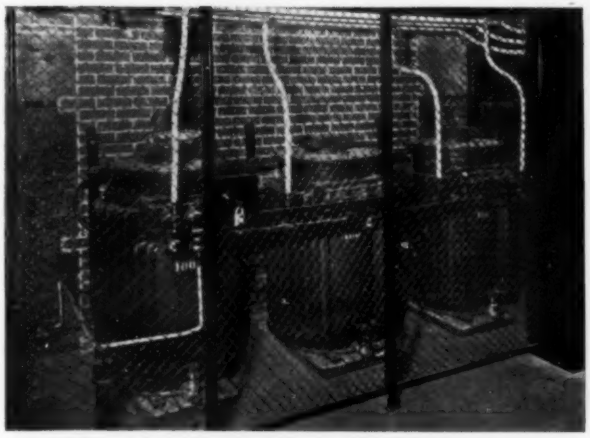
### Trussless Roof

A new type of sawtooth roof for industrial buildings, which provides for broader factory aisles and eliminates the usual maze of trusses and cross members found in this sort of construction, has recently been announced by the Austin Co., Cleveland, Ohio. The construction provides full ceiling height and maximum uniform daylight, employing a new rigid sawtooth frame which is formed by welding together of rolled sections. It is said to permit economical construction of aisles up to 50 ft. in width.

### New Products

A dolomite limestone deposit now being worked by the Ohio Hydrate & Supply Co., Woodville, Ohio, is stated by this concern to be the purest mineral of this type ever discovered. It contains 99.67 per cent calcium-magnesium carbonate, with only 0.03 per cent iron oxide. In

**Rigid sawtooth construction for factory buildings**



**Transformers Installed Indoors**

Owing to the use of Pyranol, a non-flammable material substituted for transformer oil, and manufactured by the General Electric Co., Eli Lilly Co., of Indianapolis, was able to install these three 100 k.v.a. transformers inside the plant, without the use of a fireproof vault. This made possible short secondary leads to the load centers and an economical installation. A switchboard is situated in the rear of the transformer bank, just beyond the brick wall.

Single swinging sacking scale

Small forged steel steam trap for 450 lb. pressure

preserving the purity of the deposit, electric mining equipment is used and the pyrometer-controlled kilns are fired only with a certain grade of coal from a single mine.

A new line of paints put out by the Efkalin Co., 804 East 141st St., New York City, is available for indicating temperature through changes in the color of the paint. Five paints of the line change permanently in color when exposed to temperatures in the range from 300 to 734 deg. F., while seven of the paints return to the original color on cooling, changing color in the range from 122 to 464 deg. F. The safe margin for the reversible-change paints is 25 deg. F. The paints can be used to indicate undue heating in bearings, show liquid levels in vessels containing hot liquids, and indicate serious deviation in temperature of process equipment, power transmission machinery and other devices.

Nevillite is the name of a new thermoplastic hydrocarbon resin which, according to the manufacturer, the Neville Co., Neville Island P. O., Pittsburgh, Pa., can be used for the manufacture of superior white enamels and acid- and alkali-resisting coatings. Various grades are available, some of them recommended for use as adhesives and for rubber compounding.

This same concern has announced a new odorless, water-white plasticizing oil, under the name of Nevillite oil. This is a colorless hydrocarbon of good light and heat stability, high solvent power, wide compatibility and very high boiling range. It is inert, neutral and viscous and is said to impart unusual chemical stability to materials with which it is combined. It is a plasticizer for most natural and synthetic gums and resins and dissolves them or mixes homogeneously with their solutions. It is particularly suitable, according to the manufacturers, for the plasticizing of chlorinated rubber coatings.

## Sacking Scale

A new type sacking scale, which is available in four modifications, has recently been announced by the Exact Weight Scale Co., Columbus, Ohio. A tare weight to compensate for the weight of the bag in any amount up to 10 lb. is placed on the beam and additional weights added for the specified net capacity. A dial reads from 25 lb. underweight, through the predetermined net weight, to 5 lb. overweight. Thus the operator is able to fill at top speed until the scale begins to register and then cut down the delivery to stop the flow when the scale indicates the correct quantity.

The four modifications, Models 2225, 2226, 2228, and 2229, are respectively units for floor installation, free-swinging from a single post, a double-swinging unit and a ceiling suspension unit. They are adapted to the handling of any free-flowing material such as fertilizers, chemicals or sugar.

## Forged Steel Trap

High-pressure steam drips at pressures to 450 lb. ga. can be handled in a small, new, relatively low-priced, forged-steel steam trap, Model 312, recently announced by the Armstrong Machine Works, Three Rivers, Mich. The trap is made in ½ and ¾ in. sizes, and may be had in both flanged and screw connection types. This trap is of the bucket type, with all interior mechanism of stainless steel. At 450 lb. pressure it has a continuous discharge capacity of approximately 2,500 lb. of hot condensate per hour.

## Equipment Briefs

For the packaging of such products as oils, alcohols, thinners and similar materials requiring a container which permits small quantities to be poured without waste, the Geuder, Paeschke & Frey Co., West St. Paul Ave. and North 15th St., Milwaukee, Wis., has introduced a new steel drum known as the Pour-Klean. The spout has a tilted lip to prevent waste in pouring. The drum itself is of heavy gage steel, equipped with a screw plug, tamper-proof combination seal and dust cap, and a strong carrying handle with wood grip.

Production of 1 qt. of distilled water per hour at a current consumption of 800 watts is accomplished by a new midget water still recently announced by the Precision Scientific Co., 1743 North Springfield Ave., Chicago, Ill. The still is built of heavy brass and copper, with all evaporating and condensing surfaces coated with block tin. It requires no permanent piping connections since water supply and drain connections may be made of rubber tubing. Volatile gases are expelled at the top of the long condensing column, rendering the water gas-free.

A new "Low-Head" gyratory

sifter, designed to meet the need for a small compact machine for the grading and sifting of chemicals and non-abrasive mineral products, has been announced by the Allis-Chalmers Mfg. Co., Milwaukee, Wis. The new sifter has an aluminum body, individual motor drive and rubber mountings, both top and bottom, for the hanger rods. It is operated from a light socket of either 110 or 220 volts and is available with either two or three decks each having 5 sq.ft. of cloth surface.

A high hoisting speed of 60 ft. per min. for loads of 250 and 500 lb. is available in a new close-headroom junior type hoist, built in two sizes by Electro Lift, Inc., 30 Church St., New York City. The mechanism of the hoist extends but 11 in. below the track from which it is supported. The drive is of the worm type, inclosed in an oil-tight and dust-proof gear case with oil bath lubrication. The lift is 15 ft. and the control either by push-button or rope.

An improved group of in-line, horizontal, three-stage compressors for pressures from 750 to 2,500 lb. is being offered by Worthington Pump & Machinery Corp., Harrison, N. Y. The compression cylinders require only one packing box which is subjected solely to moderate pressures. The machine is intended for compressing air and other gases such as oxygen, helium, hydrogen and refinery or natural gas. A choice of steam or motor drive is offered.

## MANUFACTURERS' LATEST PUBLICATIONS

**Achema VIII.** Dechema, Potsdamer Strasse 103a, Berlin W 35 Germany—16-page prospectus in English describing the forthcoming Chemical Engineering Exposition, Achema VIII, to be held at Frankfurt a.M., Germany, July 2-11, 1937.

**Cements.** Pennsylvania Salt Mfg. Co., Philadelphia, Pa.—Booklet 3—Discusses construction of acidproof masonry for acid recovery systems, flues, tanks, walls, etc., using this company's Penchlor acid-proof cement.

**Chemicals.** Grasselli Chemicals Department, E. I. du Pont de Nemours & Co., Wilmington, Del.—Pocket-sized pamphlet listing approximately 330 products made by this company; illustrated folder on C.P. reagents; pamphlet on Nogas, an aid to pickling iron and steel; revised booklet on inhibitors; new pamphlet on trisodium phosphate; new pamphlet on insecticides and fungicides.

**Coatings.** Metallizing Co. of America, 1351 E. 17th St., Los Angeles, Calif.—36-page booklet describing and illustrating numerous applications of the metal spraying process.

**Combustion.** Simplex Oil Heating Corp. 30 Church St., New York City—Bulletin 119-37—4 pages describing this company's horizontal rotary industrial oil-burning systems.

**Conduits.** H. W. Porter & Co., 825 Frelinghuysen Ave., Newark, N. J.—Booklet briefly illustrating and describing this company's underground steam conduit system.

**Electrical Equipment.** Fairbanks, Morse & Co., 900 South Wabash Ave., Chicago, Ill.—Bulletin 1600—4 pages on this company's polyphase slip-ring or wound-rotor induction motors.

**Electrical Equipment.** General Electric Co., Schenectady, N. Y.—Bulletin GEA-2505—8 pages describing Type AF-1 circuit breakers for use instead of fuses in industrial applications.

**Electrical Equipment.** Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—Catalog Section 42-210—15 pages on polyphase detachable meters. Also catalog section 42-104, 6 pages on switchboard watt-hour meters; descriptive data 32-165, 7 pages on cubicle type switchgear; and leaflets L-20627-A and L-20628-A, four pages each on "De-ion" combination and non-reversing line starters.

**Equipment.** Cement Gun Co., Allentown, Pa.—Bulletin 1200—65 pages covering the cement gun with much technical information in regard to uses.

**Equipment.** Patterson Foundry & Machine Co., East Liverpool, Ohio—4-page leaflet describing this company's dissolver for the dissolving of viscous materials and the dispersion of pigments and chemicals.

**Equipment.** S. Morgan Smith Co., York, Pa.—Bulletin 132—32 pages describing this company's wide range of water power equipment; also leaflets describing production facilities and this company's welding service.

**Furnaces.** Ajax Electrothermic Corp., Trenton, N. J.—Bulletin 11—16 pages describing large coreless induction furnaces and accessories.

**Graphite.** Acheson Colloids, Corp., Port Huron, Mich.—Technical Bulletin 260, Sections A and B—8 pages total dealing with impregnation with colloidal graphite, from (A) the theoretical and (B) the practical standpoint.

**Heaters.** Harold E. Trent Co., 618 North 54th St., Philadelphia, Pa.—Leaflet briefly describing vane-type electric strip heaters for air heating, showing characteristics.

**Instruments.** American Schaeffer & Budenberg Division, Bridgeport, Conn.—Catalog 2400—8 pages describing in detail this company's wide range, non-indicating controllers.

**Instruments.** Automatic Temperature Control Co., 34 East Logan St., Philadelphia, Pa.—Bulletin G12—6 pages on current input controllers for ovens, furnaces, and other electrically heated units.

**Instruments.** Bailey Meter Co., 1050 Ivanhoe Road, Cleveland, Ohio—Bulletin 301—40-page catalog of this company's fluid meters for steam, liquids and gases, covering types and accessories; also Bulletins 163 and 194, respectively, 14 pages on multi-pointer draft gages and 4 pages on this company's electrical transmitting system for indicating, recording and integrating at distant points.

**Instruments.** The Bristol Co., Waterbury, Conn.—Bulletin 483—8-page bulletin describing this company's new line of low-range pressure and draft recorders and controllers.

**Instruments.** Esterline-Angus Co., Indianapolis, Ind.—Bulletin 1236—4 pages on time recorders and their industrial uses.

**Instruments.** The Foxboro Co., Foxboro, Mass.—Bulletin 210—24 pages on this company's Stabilog controllers for liquid level, discussing instruments and application methods; also 4-page leaflet describing this company's new absolute pressure recording gage.

**Instruments.** Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.—Catalog EN-96—32-page catalog covering hydrogen-ion concentration measurement and its indication and recording in laboratory and plant.

**Instruments.** C. J. Tagliabue Mfg. Co., Park & Nostrand Aves., Brooklyn, N. Y.—Catalog 900C—32 pages completely describing non-indicating temperature and pressure controllers of numerous types made by this company; also catalog 1100A, 16 pages on laboratory thermometers and hydrometers.

**Lubrication.** Alemite Division, Stewart-Warner Corp., Chicago, Ill.—1937 industrial catalog covering in 56 pages entire range of this company's industrial lubrication equipment; also revised industrial lubrication manual for maintenance engineers.

**Lubrication.** Shell Petroleum Corp., Shell Bldg., St. Louis, Mo.—24-page non-technical "Panorama of Lubrication," presenting in educational form for students and engineers an interesting account of the progress of lubricating oil refining from the early past to the present.

**Materials Handling.** Harnischfeger Corp., 4400 West National Ave., Milwaukee, Wis.—Bulletin H-5—Discusses and illustrates numerous industrial applications of this company's hoists.

**Meters.** Worthington Pump & Machinery Corp., Harrison, N. J.—Bulletin M-975-B34—8 pages describing this company's heavy duty disk type water meters.

**Ovens.** Precision Scientific Co., 1750 North Springfield Ave., Chicago, Ill.—Bulletin 300—8-page condensed catalog of this company's Freas constant-temperature laboratory equipment.

**Packaging.** The Paper Service Co., Lockland, Ohio—Leaflet describing flexible waterproof paper linings for bags.

**Packings.** U. S. Rubber Products, Inc., Mechanical Goods Division, 1790 Broadway, New York City—112-page manual on industrial packings, giving engineering data and characteristics of each packing, together with tables of useful engineering information.

**Products.** Koppers Co., Pittsburgh, Pa.—26-page booklet briefly listing chemicals and a wide range of other products including paints, gas-plant equipment, coal byproducts, etc., produced by this company and its numerous affiliates.

**Proportioning Pumps.** Milton Roy, 2031 E. Madison St., Philadelphia, Pa.—4-page leaflet describing rocker-arm and motor-drive proportional pumps for water conditioning.

**Pumps.** Beach-Russ Co., 50 Church St., New York City—Bulletin 61—4 pages describing this company's Type CP rotary liquid pumps.

**Pumps.** DeLaval Steam Turbine Co., Trenton, N. J.—Catalog BF-100—12 pages describing with illustrations and engineering data this company's close-coupled, motor-mounted centrifugal pumps.

**Pumps.** Fairbanks, Morse & Co., 900 South Wabash Ave., Chicago, Ill.—Bulletin 6165—6 pages on duplex self-oiling power pumps for handling mud, slush, clear water, petroleum products, etc.

**Regulators.** Chowning Regulator Corp., Corning, N. Y.—Bulletin 33—4 pages describing remote gas pressure regulators and controllers for use with gas producers.

**Regulators.** Davis Regulator Co., 2541 South Washtenaw Ave., Chicago, Ill.—4-page leaflet covering in compact form selection of the proper type of pressure regulator for numerous types of service.

**Rubber.** B. F. Goodrich Co., Akron, Ohio—Catalog Section 7900—4 pages describing rubber vibration insulators for mechanical equipment.

**Screens.** W. S. Tyler Co., 3600 Superior Ave., N. E., Cleveland, Ohio—64-page catalog giving list prices and specification tables covering a wide range of woven wire screens.

**Transite.** Johns-Manville Corp., 22 East 40th St., New York City—80-page Board of Fire Underwriters report on Transite pressure pipe and couplings, in sizes from 4 to 24 in., for use in underground water service at pressures not exceeding 150 lb.

**Welding.** Lincoln Electric Co., Cleveland, Ohio—Spec. Bulletin 320—4 pages describing Type S-6018 engine-driven 400-amp. arc welders.

Your Plant NOTEBOOK

# "Visualizer" Aids Valve Operation

A SIMPLE, effective, but none-the-less amusing device that has been employed for some time in the refinery of the Pennsylvania Sugar Co., at Philadelphia, is a valve position indicator or "visualizer" which has been found extremely useful by the vacuum pan operators in controlling the flow of water to the pan condensers. In Fig. 1 the visualizer appears, mounted on the valve control shaft, just above the handwheel. It is a 9 in. disk of $\frac{1}{8}$ in. steel, edged with a $\frac{1}{2}$ in. facing of brass to simulate a valve disk. As the handwheel is turned to operate the valve which is not visible in the picture, the disk is exposed through a circular hole in a panel, the hole simulating the valve seat. Movement is imparted to the visualizer by a pair of bevel gears, one mounted on the shaft, the second driving a screw of the same pitch as the valve stem. A nut running on the screw moves the disk so that its position relative to the opening in the panel is the same as that of the actual valve disk relative to its seat. This construction is indicated in the drawing, Fig. 2.

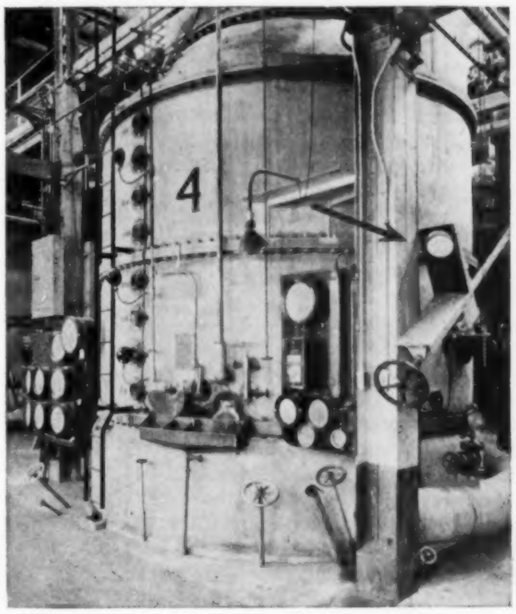
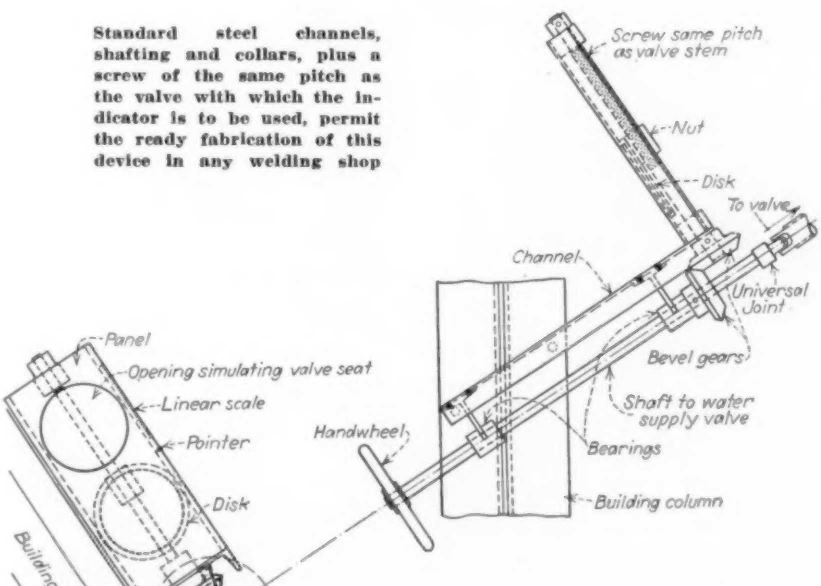


**Fig. 1—One of the vacuum pans with arrow pointing to the valve position indicator**

Thus, at a glance, the operator can determine immediately the degree of opening of the valve and can estimate the quantity of water it will pass with much greater accuracy than would be possible with a simple linear indicator alone. For further assistance, however, there is also a linear indicator, a pointer moving on a scale, shown at the right hand edge of the panel in Fig. 1. By glancing at it the operator knows immediately the number of turns of the valve stem.




**Standard steel channels, shafting and collars, plus a screw of the same pitch as the valve with which the indicator is to be used, permit the ready fabrication of this device in any welding shop**

**Fig. 2—Detail of valve position indicator showing construction**

### Lift Bridge Spans Tracks Separating Buildings

AT THE PLANT of the Geo. A. Hormel Co., Austin, Minn., is a novel lift bridge which connects two buildings that are separated by a railroad siding. The floors of the buildings are on about the same level as the car floors and when cars are not in the siding it is desirable, for inter-building trucking, to be able to connect the buildings without using ramps or a bridge at an upper floor level. The solution was to fabricate a lift bridge of structural steel, inclosed to permit communication under all weather conditions. When cars are to be run into the siding the bridge is lifted by means of a 3-ton P & H electric hoist, manufactured by the Harnischfeger Corp., which is installed in one of the buildings. Operated by a simple push-button control, the bridge can quickly be moved at a moment's notice. Presumably, a similar arrangement could be used equally well to connect any of several floors.

# Chemical Engineering NEWS

### A.S.M.E. to Hold Semi-Annual Meeting in Detroit

PLANS for the 1937 Semi-Annual Meeting of The American Society of Mechanical Engineers, to be held at Detroit, Michigan, May 17-21, with headquarters at the Statler Hotel, were advanced to a point where the tentative program has been announced. The Papers Committee, which is headed by Harry T. Woolson, executive engineer of the Chrysler Corp., has set up a series of six general sessions which will be held on the mornings and evenings of Tuesday, Wednesday, and Thursday, culminating in a dinner scheduled for Thursday evening. On the afternoons of these same days plant visits and simultaneous sessions of the various professional divisions are to be held. At the general sessions, eminent authorities from the engineering and industrial fields of the Detroit area will develop a broad survey of the modern techniques employed by the mass-production industries typified by the automobile builders, and the special technological problems in which lie the varied interests of the professional divisions.

### Unfair Competition Charged In Nitrate of Soda Sales

USE of unfair methods of competition involving false and misleading advertising in promoting the sale of Chilean nitrate of soda is charged in a complaint issued by the Federal Trade Commission against Chilean Nitrate Sales Corp., New York.

Also named as a respondent is Chilean Nitrate Educational Bureau, Inc., a subsidiary disseminating advertising material for Chilean Nitrate Sales Corp., which has branch offices at Raleigh, N. C.; Atlanta, Ga.; Montgomery, Ala.; Jackson, Miss., and Los Angeles.

In addition to advertising in newspapers, magazines and circulars to purportedly describe the efficacy of nitrate of soda imported from Chile, the respondent corporations are said to have made and exhibited to large audiences of purchasers and prospective purchasers of their product, a motion picture with dialogue, divided into two distinct sections.

The first part of the film portrayed the mining and refining operations and other details necessary to bring the respondent corporations' product to the American farmer. The second section, according to the complaint, was a photographic history of an experiment in which the effect of Chilean nitrate of soda on plant growth is compared with the effect of synthetic nitrate of soda.

The complaint alleges that the respondent corporations prepared and presented the material in their advertising matter and motion picture in such manner as to represent falsely, either directly or by implication.

### General Chemical Acquires Mechling Bros.

THE Allied Chemical & Dye Corp., through its subsidiary, the General Chemical Co., has acquired the assets and business of the Mechling Bros. Chemical Co., of Camden, N. J. The business of the latter company in the future will be carried on under the designation of Mechling Bros. Chemical Division of General Chemical Co.

Plants of the Mechling company are located at Camden and at Medford. It is reported that Benjamin S. Mechling and Edward A. Mechling, the president and vice-president of the company will retain an active interest in the new arrangement.

### Porcelain Enamel Institute Will Hold Forum

PLANS for the first annual Porcelain Enamel Institute Forum are rapidly nearing completion. The Forum will be held May 5, 6 and 7 at the University of Illinois, and will be open to everyone in the porcelain enameling and related industries.

Prominent among the speakers at the Forum, in addition to the regular technical program, will be Robert G. Calton of the Tennessee Enamel Mfg. Co., president of the Institute, and the two Institute vice-presidents —F. E. Hodek, Jr., of the General Porcelain Enameling & Mfg. Co., and E. L. Lasier of the Titanium Alloy Mfg. Co. President Calton will make the response to an address of welcome to be given by the president or some other representative of the University of Illinois. Mr. Hodek, who is also chairman of the committee in charge of the Forum, will talk on "Forum Plans for 1938." Mr. Lasier's subject will be "The Institute and the Enameler."

### Great Lake Steel Corp. Will Build Coke Plant

THE Semet-Solvay Co., one of the wholly owned subsidiaries of Allied Chemical and Dye Corp., has been awarded by the Great Lakes Steel Corp. of Detroit a contract for a 130 oven byproduct coke plant. The project calls for the construction on Zug Island on the Detroit River, of two batteries of Semet-Solvay vertical flue combination ovens. The byproduct plant will include a benzol refining unit.

The design of the coke ovens provides for heating with blast furnace gas, releasing the coke oven gas to the steel mills. The coke oven gas will be piped through a large gas line to the mills at Ecorse.

### Ethyl Gasoline Corp. Building New Plant

A NEW ethyl fluid plant under construction at North Baton Rouge, La., is to be the first step in the decentralization of plants manufacturing ingredients for leaded gasoline, it is announced by the Ethyl Gasoline Corp.

The plant, which is being built by E. I. du Pont de Nemours and Co., is expected to be ready for operation by next July, employing a personnel of 150 men. Paralleling the work of four production units at Deepwater, N. J., the new facilities are planned for a production capacity equal to 20 per cent of anticipated 1937 business in ethyl fluid.

Later a second unit will be built at North Baton Rouge, enabling the company to supply demands for antiknock gasoline in the Southwest and on the Pacific Coast from the Louisiana plant.

## Student Chemical Engineers Hold Convention

MORE than 200 members of ten student chapters of the American Institute of Chemical Engineers in the Metropolitan New York area met at the Polytechnic Institute of Brooklyn, March 5-6 for their first annual convention. An organizing committee under the general supervision of Professor John C. Olsen and actively headed by Joseph J. Jacobs, Jr., of the Brooklyn Chapter, had planned an extensive program which included inspection trips, a chemical engineering seminar, a student paper contest and a final banquet at the Chemists' Club.

Speakers at the seminar were Dr. Gustav Egloff of Universal Oil Products Co., Chicago, and a director of A.I.Ch.E. He spoke on "Some Modern Aspects of the Petroleum Industry." Albert E. Marshall, past-president of the Institute and chairman of its Committee on Professional Guidance, gave a semi-serious talk on "Professional Development After Graduation," interjected with frequent references to his glasses which he was afraid would reflect the flash as the candid photographer snapped his picture.

At the banquet John P. Hubbell, chairman of the Metropolitan New York Section of A.I.Ch.E. awarded the $15 prize for the best student paper to David S. Plumb of the Princeton University Chapter, whose topic was "Technological Importance of Reclaimed Rubber." (See pages 194-7 of this issue.) The second prize of $10 was won by I. R. Landau of the University of Pennsylvania who presented a paper on "Attacking Corrosion by Electron Diffraction." The judges were Stephen L. Tyler, executive secretary of A.I.Ch.E., D. H. Killeffer of *Industrial & Engineering Chemistry* and S. D. Kirkpatrick of *Chem. & Met.*

Because of illness, Dr. Graham Edgar, vice president of the Ethyl Gasoline Corp. was unable to attend the banquet and Professor John C. Olsen, head of the Department of Chemical Engineering at the Polytechnic Institute, spoke on the same topic: "Extraction of Bromine From Sea Water." Dr. Edgar had provided a moving picture of the Bromine extraction plant at Wilmington, N. C. which was shown to the delegates.

**CHEMICAL ENGINEERS ADDRESS STUDENT CHAPTER DELEGATES**

**1. Gustav Egloff of Universal Oil Products. 2. A. E. Marshall, Chairman of A.I.Ch.E. Committee on Professional Guidance. 3. John P. Hubbell, Chairman of New York Section, A.I.Ch.E. 4. S. D. Kirkpatrick, Secretary, A.I.Ch.E. Committee on Professional Guidance. 5. John C. Olsen, General Chairman of Arrangements for Brooklyn Convention.**

*Candid Photos by R. D. Sheeline Brooklyn Polytechnic Ch.E. '38*

## New Research Laboratory For Brown

A GIFT of $500,000 to Brown University to construct a new chemical research laboratory has been announced by President Henry M. Wriston. The gift is from Jesse H. Metcalf, former United States senator from Rhode Island and a member of Brown's board of trustees.

The fund will be used to build and endow a laboratory "with unsurpassed facilities" for research in specialized phases of electro-chemistry, and photochemistry, fields of increasing importance in the scientific and industrial worlds. The new building will more than double Brown's research facilities.

## Major General Baker Heads C. W. S.

AFTER May 23—Chemical Warfare Service will be commanded by Major General Walter C. Baker, who has been on duty at the headquarters of the First Corps Area, Boston. Colonel Baker, who succeeds Major General Claude E. Brigham, has been a member of C.W.S. since 1920, having joined the regular army as second lieutenant of Coast Artillery in 1901.

## BRIGHT PROSPECTS FOR BRITISH CHEMICAL HOME AND EXPORT TRADE

**From Our London Correspondent**

PROSPECTS for British export trade are brighter than for some time. Simultaneously, recovery in home trade seems to be approaching a peak. In their business forecast for the first quarter of 1937 the Federation of British Industries states it is too early to judge whether maximum activity in home trade will be reached this year or next. Chemical industry, however, has prepared to meet increased demand from home and abroad, and, judging by the inquiries received at the British Industries Fair, new developments in manufacture will not have been in vain. As in the case of previous Fairs, the chemical products section at Olympia in London was organized by the Association of British Chemical Manufacturers. Chemical plant and related machinery is not represented, owing to the fact that its specialized nature is most conveniently handled at the exhibitions organized at five year intervals, by the British Chemical Plant Manufacturers' Association. Nevertheless, among the so-called heavy industry exhibits. at Birmingham, users of chemical equipment—especially from the power and plant accessories aspect—could find much to interest them.

In the chemical products section many products were exhibited for the first time, either as entirely new or offered in new form. In three cases they provided evidence of outstanding enterprise during the past year, the first British plant having been put into operation for sodium chlorate, potassium permanganate having been restored to the list of British-made chemicals, and the manufacture of oxalic acid having been established after many difficulties. Other additions include strontium salts, for which there is a limited but steady demand; camphor, now obtainable in pharmaceutical and commercial qualities and in sufficient quantity to meet all home demands; d-sorbitol, which finds industrial uses, although introduced as a sweet carbohydrate of high food value and mainly imported from the United States; mannitol, phenazone, calcium gluconate, cyclohexylamine and phthalic esters. In spite of limited demand, British production of strontium salts seems appropriate as the bulk of supply of raw material (the mineral sulphate, celestite) is mined in Gloucestershire; a notable rise in German export figures (from 31 tons in 1933 to 52 tons in 1935) shows that world demand for strontium compounds is increasing. For industrial purposes sorbitol is supplied as 80 per cent colorless syrup.

Triphenyl phosphate is now available in convenient flake form; commercial sodium lactate is obtainable in 80 per cent solution, free from magnesium and copper salts, is stable in steam, and capable of replacing glycerine where hygroscopicity characteristics are desired; soda crystals have been introduced in a new form for household uses. In addition, the recent British Industries Fair provided evidence of new supplies of benzoic acid and sodium benzoate; an increase in the available range and purity of phenols, cresols and their derivatives; the introduction of a synthetic alternative to olive oil for textile use; and chlorinated phenolic compounds for use as disinfectants and for preventing mold growth.

Several research associations have extended their laboratory accommodation. The greatest extensions have taken place at Shirley Institute, headquarters of the Cotton Research Association, but notable additions also have been made by the Paint Research Association (Teddington), the Laundry Research Association (Hendon), and the British Association of Research for the cocoa, chocolate, sugar, confectionery and jam trades (Holloway). At the last named association laboratory extensions were opened by Sir William Bragg, in January. At the Chemical Research Laboratory, Teddington, an improved electrical insulating material has been obtained by blending rubber derivatives with synthetic resins.

Private enterprise in research is equally progressive. On Feb. 24, Prof. F. G. Donnan, president-elect of the Chemical Society, opened a group of new laboratories at the Luton works of B. Laporte, Ltd., manufacturers of hydrogen peroxide and such per-compounds as ammonium persulphate and sodium peroxide.

The second reading of the British Oxygen Company's Caledonian Power Bill, which proposed to establish a hydroelectric plant in the Highlands of Scotland for the supply of power in connection with the manufacture of calcium carbide, was rejected in Parliament on March 10.

Preliminary work on extensions to the Lochaber factory of the British Aluminum Co. started early in February; these extensions involve the laying of two new pipe lines (alongside existing pipes) to convey water down the mountain side to the factory power-house. With prospects of an increased production of aluminum, Magnesium Elektron Ltd., is examining a new method whereby British deposits of dolomite may be substituted for imported magnesite.

The D'Arcy Exploration Co., a subsidiary of the Anglo-Iranian Oil Co., has abandoned the search for mineral oil at Portsdown Hill, near Portsmouth, owing to the fact that they have encountered non-porous rock at a depth of 6,500 ft. after drilling for nearly twelve months without finding oil in sufficient quantity to justify further work. New drilling operations will be carried on at other sites for which licenses have already been granted, notably Aislaby, near Whitby, and Kingsclere, near Newbury. South Wales is hoping that the government's new plans to aid distressed areas will include the erection of a chain of small low temperature carbonization and hydrogenation plants throughout the coal-field, in view of the fact that a special committee of experts, under the auspices of the National Industrial Development Council of Wales, has investigated oil extraction processes best suited to Welsh coals, and has issued an interim report. Almost simultaneously, the Sugar Commission has been asked by the Government to report on the possibility of establishing a beet sugar factory at Pembroke, at a cost of about £250,000.

Recent developments by Imperial Chemical Industries Ltd., include the application of "Perspex," a new transparent plastic, to optical lenses, and the introduction of a new milk bottle cleansing medium. The lenses, which claim to have superior optical properties to glass, can be molded to any exact curvature with a polished surface and ready for inserting into instruments with an optical system. The new cleanser, "Melacos," is claimed to have all the valuable properties of caustic soda, without its bad rinsing qualities and its tendency to form scale when used in hard water.

## RISING COMMODITY PRICES STIMULATE SYNTHETIC PRODUCTION IN GERMANY

**From Our German Correspondent**

THE recent flurry in prices on the London market for tin, rubber and other products has aggravated Germany's raw material difficulties, and according to industrialists further justifies Germany's policy of making herself independent of world raw material monopolies through domestic and synthetic production. With the feverish armament programs being carried out in Europe, raw material shortages are also being experienced by countries which are even in a better position than Germany to pay for imports. Several countries have recently prohibited or restricted the exportation of scrap iron, and the resulting scarcity has been felt by many German industries.

On the other hand, international cooperation has been good in the steel export field. In "Stahl und Eisen" it is stated that the IREG, the international raw steel export cartel which was founded in 1933 (original IRG in 1926) by Germany, France, Belgium and Luxembourg and now includes England, Poland, and South Africa, controls 80% of world steel imports, the remainder belonging to the outsiders U.S.A., Japan, and Sweden. During the depression the various specialized cartels for pipes and tubing, rails, wire, etc., managed to keep prices twice as high as for non-regulated products, and were able to increase sales despite the higher prices.

A price and market agreement concluded in February between the English and Belgian cement industries was extended on March 1 to include German, French, Scandinavian and Jugoslavian cement industries, and has already accomplished a rise in prices. The prospects for the establishment of an international coke cartel are also considered favorable, for even though the present scarcity does not make such an organization necessary, it is felt that it would help prices.

Wood is becoming increasingly important in Germany as a domestic raw material. Although the trees and the scientific timber operations in German and west European forests do not compare in size with American or Russian logging operations, they are nevertheless important for the respective countries, and the almost 100% economical utilization of Germany's wood—one of her few raw materials—should be of interest to chemists and engineers. The difference in the scale of operations is evidenced, for instance, by the fact that timber is recorded in German agricultural statistics as a "crop" to be harvested every 20 years. Since 70 per cent of Germany's forests are owned by the state or the communities, it is easy in connection with the "four year plan" to regiment this branch. For the coming two years, for instance, it has been decreed that 150 per cent of a normal year's cutting be undertaken, and every private forest owner must report the amount of timber cut down. Special market and price regulations have already been issued.

Because of the low price of the raw material in relation to the value of the finished product, considerable amounts of wood are also imported, but the newer cellulose and paper factories are being established chiefly at favorable importing points, such as seaport towns, rather than near the domestic forest areas. The freight charges for domestic wood to these points are often higher than the costs of transport from abroad.

In Carlsruhe in Upper Silesia a factory has just resumed operations for chemically processing pine needles to make upholstery wool. Wooden corks and stoppers are also being produced commercially from poplar and ash wood in an effort to reduce the annual 10 million RM import item of cork, according to an announcement of the technical committee of the German forestry association.

To take advantage of favorable prices abroad, during the past few months as high as 80 per cent of Germany's paper pulp has been exported, leaving only 20 per cent to fill domestic demands. Large printing and publishing houses have thus been experiencing paper shortages and must order paper at least three months in advance and are even then not sure of securing the amount ordered. Since January 1, 1937, the syndicate has reduced the allotment of pulp for the various German paper factories.

To save raw materials further the paper control board has decreed that after March 1, cellophane may no longer be used as an outer wrapping material for food and other products, if these are already packed in other material or unless hygienic reasons require it. Coffee, tea, and tobacco products may no longer be wrapped in cellophane, although exceptions are made in the case of goods being packed for export.

Cellulose production in Germany is constantly increasing. The Zellstoffabrik Waldhoff and the Vereinigte Zellstoff und Papierfabriken Kostheim A. G. with plants located in the Rhineland, East Prussian, and Upper Silesian forest areas report an annual production of 500,000 tons of specialized cellulose, chiefly for paper and staple fiber.

A new cellulose plant, the Westfaelische Zellstoff A. G. located in Arnsberg, Westphalia, has been founded with a capital of 2.19 million RM. The Rheinische Zellwolle A. G., manufacturing "cellulose wool," or staple fiber, intends to increase its capitalization from 600,000 to 4,000,000 RM.

The production of staple fiber in Germany should reach 85,000 metric tons in 1937, according to latest estimates. This would be nearly twice as high as in 1936, five times higher than in 1935, and nearly twenty times higher than in 1933.

Chemical Engineering NEWS

## CALENDAR

ELECTROCHEMICAL SOCIETY, seventy-first general meeting, Philadelphia, Pa., April 28 to May 1.

THIRD DEARBORN CONFERENCE OF AGRICULTURE AND INDUSTRY, Detroit and Dearborn, Mich., May 25-27.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, semi-annual meeting, Toronto, Canada, May 26-28.

AMERICAN PETROLEUM INSTITUTE, mid-year meeting, Colorado Springs, Colo., June 1-3.

AMERICAN SOCIETY FOR TESTING MATERIALS, annual meeting, Waldorf-Astoria Hotel, New York City, June 28 to July 2.

16TH CHEMICAL EXPOSITION, Grand Central Palace, New York City, December 6-11.

WASHINGTON continues to operate a circus with many main rings and a surplus of side shows. Just now the principal spotlights of industrial attention turn on questions of Supreme Court reform, labor legislation, and taxes. But industrial executives should not have their attention too much diverted from the legislative and administrative developments in minor spots on the Washington reform program. Some of the side shows, at which the barkers are strangely silent, may need closest attention. As with a naughty youngster, silence is ominous.

# NEWS FROM WASHINGTON

**Washington News Bureau**
**McGraw-Hill Publishing Co.**
**Paul Wooton, Chief**

### More Taxes? Yes!

There now appears to be no doubt that there will be a new tax bill enacted by the present Congress perhaps in May or June. Current receipts from corporation and individual income taxes are below the Treasury expectation. The deficiency is estimated, at the end of March, variously from $100 million to $400 million. And disbursements continue above estimated spending. Reliable forecasts, therefore, indicate a deficit at the end of the present fiscal year, June 30, of approximately $500 million *more* than was expected when the President submitted his budget to Congress the first of January.

About half of the departmental and special appropriation bills have passed the House. The Senate has acted on several of these bills. At neither end of the capital is there any evidence of a sincere desire for economy. Any effort to keep the budget within teetering distance of balance must, therefore, be made by new tax levies.

### Trade Rules

A proposal that *all* industrial advertising be supervised by Federal Trade Commission, Representative Lea's newest plan to augment the authority of F.T.C., is being vigorously pushed. General enactment of that legislation, even in rather restricted form, might hold up the Food and Drug bill another year in the House. However, the Congressmen are plenty tired of food and drug legislative quarrels. They want to get rid of the project this Spring. Forecasts are, therefore, that the House will pass a bill which in conference can be formulated in a way to satisfy the President. Wishful forecasters, perhaps not too hopefully, expect that full regulation will remain with the Food and Drug Administration. They apparently expect a more thorough, but an altogether fair technical job, under such authority. They are none too sure as to what F.T.C. policy would be, hence oppose it.

However the food and drug feature of regulation may come along this year, there is excellent chance that trade practice conference plans of Federal Trade will be advanced. There is a fair chance also that the Commission will be given authority to issue complaints on its own initiative and also instructed to exert moral suasion in most vigorous form against economic cheats, even when no competitive element can be proven. All these increases in authority are what F.T.C. would like. And its lobbying in the House is most effective.

### Stream Pollution

The battle over stream pollution legislation continues, but with fair prospect that the cooperative Public Health Service program will win out. That plan, as portrayed in the Vinson bill, is greatly strengthened by the approval of the use of substantial Federal funds for correcting stream pollution nuisances. States and municipalities will want P.H.S. cooperation with money, and can be counted on to support this bill.

Real delay is most likely under Senator Lonergan's plan for mandatory, rigorous, all-federal action. That arbitrary clean-up plan by a special Federal board is believed much too drastic for safe adoption. Engineering and industrial testimony in committee hearings makes it clear that nobody knows how to do some of the jobs that such a bill would command. Industrial cooperation, with clean up just as promptly as physically and economically feasible, would be the alternative. That is the plan which Public Health Service would direct.

### Good Prices

Administration leaders, including the President, are not pleased by the sharp up-trend in industrial goods prices. The President's declaration that federal money would no longer be spent for operations that tend to increase prices of construction materials and capital goods was the culmination of a series of announcements. Wall Street's apparent concern and sharp reaction may have been justified. But there was no excuse for the surprise element in this, as the trend toward price restrictions had been evident in official circles for several weeks (See *Chem. & Met.*, March, p. 165.)

Corrective action with respect to inflationary influences will be attempted sincerely by Federal Reserve officials. A definite announcement April 5 of the intention to buy government bonds for the account of Reserve banks, represents the determined effort of this group to use to the limit stabilizing influences created when the Board was reorganized. But Washington economists do not think that this agency or any other governmental body would be able to control the upward spiral of prices and wages by indirection, so long as unbalanced budget and social legislation continue to have their present powerful inflationary influence. The disciplinary and corrective methods in contemplation appear adequate to restrict profits, but not prices.

### Court Reform

The surprise presentation by Senator Wheeler of a letter from Chief Justice Hughes, in which two important associate justices concurred, verified one point definitely. There is no longer any argument as to whether a larger Court would be more efficient. Even the sharpest critic now accepts the idea that modernization, not efficiency or speed, must be the basis for the reformers' claims.

The group of history-making decisions announced by the Court on March 29 also laid one important ghost that was plaguing the defenders of the Supreme Tribunal. By validating the Washington State law fixing minimum wages for women, the Court resurveyed a judicial no-man's land. Thus an almost intolerable area, in which neither federal nor state jurisdiction had prevailed, was wiped out.

## New Mellon Institute Will Be Dedicated in May

THE new building of Mellon Institute will be dedicated May 5–9 with scientists and industrial leaders from distant corners of the globe attending its formal opening. The new structure, occupying much of a city block and built down into the ground so that its nine broad stories seem like only five, has been under construction for six years. It replaces the building on the University of Pittsburgh campus, which has been the Institute's home for the last 22 years, and will be dedicated in appreciation to its founders, Andrew W. Mellon and Richard B. Mellon.

Now nearly completed, a striking combination of classical Grecian beauty and simplicity and modern interior function, its border of majestic columns screening scores of busy research laboratories, the Institute's new home takes rank in Pittsburgh's civic district as one of the most outstandingly beautiful structures.

The building is of Ionic style. It is nine stories in height, with monolithic columns along all four sides. Built in the form of a trapezoid, its proportions are approximately 300 by 400 feet. The main entrance, reached by a succession of steps, brings the visitor to the main doorway and lobby at the fourth-floor level. Although lower floors are below ground level, interior courts provide ample daylight.

Inherent parts of the new structure are the traditional symbols attached to chemistry and other sciences, lending it character and atmosphere.

The Trustees' Dinner will be held in the evening and among the speakers will be Dr. Benjamin T. Brooks, Dr. Karl T. Compton, and Dr. F. C. Whitmore.

The speakers at the Symposium on Recent Progress in Science the following morning will include Dr. G. O. Curme, Dr. F. B. Jewett, Sir Frederick Banting, and Dr. W. W. G. Maclachlan.

Dr. Edward R. Weidlein, director of the Institute, will preside at the dedication and brief discourses will be given by Andrew W. Mellon and Richard K. Mellon, representing the founders. Following there will be addresses by three Nobel laureates, Dr. Irving Langmuir, Dr. H. C. Urey, and Dr. W. P. Murphy.

New building of Mellon Institute

## Continental Carbon Co. Now Producing Carbon Black

ON April 9, a housewarming party was held at the newly opened offices of the Continental Carbon Co., 295 Madison Ave., New York. This company, which was formed in 1936, already has its new plant in operation at Sunray, Texas. It is estimated that the plant will reach a production of 3,000,000 lb. a day by the end of next month.

The plant covers an area of 160 acres and a complete village to house its workers was a part of the building program. The supply of natural gas is drawn from the acreage of the Continental Gas Co. and from that of the Shamrock Oil and Gas Co.

Robert I. Wishnick of Wishnick-Tumpeer, Inc., is president of the new company.

## Factory Consumption of Primary Animal and Vegetable Fats and Oils, by Classes of Products, Calendar Year 1936

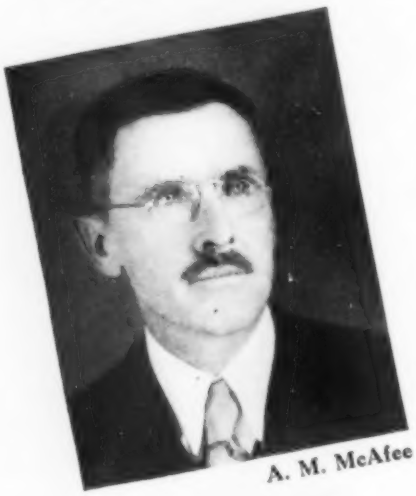
(Quantities in thousands of pounds)

| KIND | TOTAL | Compounds and Vegetable Shortenings | Oleomargarine | Other Edible Products | Soap | Paint and Varnish | Linoleum and Oilcloth | Printing Inks | Miscellaneous Products |
|---|---|---|---|---|---|---|---|---|---|
| Total | 4,784,226 | 1,610,690 | 322,719 | 363,237 | 1,394,538 | 441,282 | 101,882 | 20,206 | 321,833 |
| Cottonseed oil | 1,302,827 | 918,866 | 108,106 | 178,330 | 1,278 | 34 | ........ | 15 | 2,281 |
| Peanut oil | 103,735 | 88,470 | 4,140 | 2,419 | 1,734 | ........ | ........ | ........ | 44 |
| Coconut oil | 602,273 | 38,427 | 150,465 | 60,020 | 307,376 | 771 | ........ | 1 | 3,939 |
| Corn oil | 72,132 | 430 | 1,238 | 51,017 | 2,527 | 123 | ........ | ........ | 3,967 |
| Soybean oil | 184,563 | 113,897 | 14,262 | 21,598 | 5,023 | 14,471 | 2,886 | 62 | 3,405 |
| Olive oil, edible | 4,312 | ........ | ........ | 3,972 | 53 | ........ | ........ | ........ | 287 |
| Olive oil, inedible | 10,458 | ........ | ........ | ........ | 1,634 | ........ | ........ | ........ | 8,824 |
| Sulphur oil or olive foots | 24,577 | ........ | ........ | ........ | 23,965 | ........ | ........ | ........ | 612 |
| Palm-kernel oil | 44,104 | 627 | 2,400 | 12,490 | 26,443 | ........ | ........ | ........ | 54 |
| Rapeseed oil | 50,906 | 30,572 | 9 | 808 | 7,771 | 168 | 13 | ........ | 10,182 |
| Linseed oil | 305,330 | ........ | ........ | ........ | 1,482 | 233,340 | 50,076 | 14,968 | 5,464 |
| China wood oil | 107,875 | ........ | ........ | ........ | 2 | 94,642 | 7,131 | 2,331 | 3,769 |
| Perilla oil | 80,019 | ........ | ........ | ........ | 8 | 53,222 | 17,717 | 1,940 | 7,132 |
| Castor oil | 31,855 | ........ | ........ | ........ | 1,623 | 3,766 | 1,066 | 158 | 25,242 |
| Palm oil | 301,373 | 168,808 | 1,402 | 195 | 78,453 | 1 | ........ | 2 | *24,449 |
| Sesame oil | 55,335 | 33,120 | 57 | 16,728 | 1,869 | ........ | ........ | ........ | 21 |
| Sunflower oil | 1,230 | 208 | 5 | 920 | ........ | 97 | ........ | ........ | ........ |
| Babassu oil | 35,764 | 5,368 | 16,114 | 2,995 | 8,993 | ........ | ........ | ........ | 36 |
| Other vegetable oils | 43,904 | 15,640 | 442 | 5,025 | 4,268 | 4,614 | 6,758 | ........ | 4,955 |
| Lard | 7,318 | 4,503 | 2,198 | 471 | 9 | ........ | ........ | 5 | 63 |
| Edible animal stearin | 44,918 | 36,358 | 3,550 | 4,370 | 320 | ........ | ........ | ........ | 320 |
| Oleo oil | 21,782 | 1,839 | 18,331 | 467 | 57 | ........ | ........ | ........ | 1,088 |
| Tallow, edible | 118,998 | 116,908 | ........ | 1,412 | 228 | ........ | ........ | 2 | 334 |
| Tallow, inedible | 725,974 | ........ | ........ | ........ | 660,020 | 135 | ........ | 7 | 65,265 |
| Grease | 204,532 | ........ | ........ | ........ | 98,714 | 94 | ........ | 468 | 104,792 |
| Neat's-foot oil | 5,727 | ........ | ........ | ........ | 41 | 7 | ........ | 1 | 5,647 |
| Marine animal oils | 35,388 | ........ | ........ | ........ | 32,603 | 17 | ........ | 11 | 2,747 |
| Fish oils | 257,017 | 36,649 | ........ | ........ | 128,044 | 35,780 | 16,235 | 235 | 36,914 |

* Includes 23,086 thousand pounds reported by the tin and terne plate industry.

# PERSONALITIES

J. H. James



A. M. McAfee

E. T. Asplundh

✦ Joseph H. James, head of the department of chemical engineering and one of the original faculty members of the Carnegie Institute of Technology, has been granted a year's leave of absence, following which he will retire from active duty. After 38 years of teaching college students, during which time he has become known as one of the pioneers in the development of chemical engineering courses, Dr. James says that he now plans to take things easy, play plenty of golf, and devote some time to his research studies.

✦ A. M. McAfee, of the Gulf Refining Co., Port Arthur, Texas, has shown both his profession and his community what a chemical engineer can do in the way of public service. In recognition of his work in promoting civic welfare and education, the Lion's Club of Port Arthur has selected him as that community's "outstanding public-spirited citizen for 1936."

✦ E. T. Asplundh, who has held the position of assistant to vice-president of the Columbia Chemical Division of the Pittsburgh Plate Glass Co., was recently elected to the directorate of that company to fill the vacancy left by the death of Edward Pitcairn. Mr. Asplundh will have his headquarters at Barberton, Ohio.

✦ Howard L. Womochel, formerly of the Burgess-Parr Co., has joined the Battelle Memorial Institute, Columbus, Ohio. He has been assigned to the technical staff of the Institute's metallurgical division.

✦ Karl B. Daniloff has joined the staff of Laucks Laboratories, Inc., Seattle, Wash., to work on synthetic resins. He was formerly chemist for the Yakima Industrial Laboratory.

✦ M. J. Creighton, general manager, Zapon division of the Atlas Powder Co., was recently made a director of the company. Mr. Creighton has charge of production and sales of all of the company's cellulose products including industrial finishes and coated fabrics.

✦ James Allison, field service metallurgist for the Union Drawn Steel Co., has been made factory manager of the Billings and Spencer Co., tool and machine makers at Hartford, Conn.

✦ Gilbert H. Durbin has been added to the staff of the Dorr Co.'s Westport mill. He is a graduate of Ohio State University and was formerly engaged in chemical research for the Lone Star Cement Co.

✦ Otto Eisenschiml, president of the Scientific Oil Co., has earned recognition as an author and historian through his recent popular book, *Why Was Lincoln Murdered?* In the course of a number of years of studying Civil War history as a hobby, he has brought to light, and now published, a number of strange and hitherto not generally known facts bearing upon the assassination of President Lincoln.

Born and educated in Vienna, Mr. Eisenschiml came to this country in 1901 and after serving three years as chemist for the Carnegie Steel Co. entered the vegetable oil field where he has become well known through his contributions to technical literature.

✦ Robert J. Moore of the Bakelite Corp. was elected group representative for the American section of the plastics group of the Society of Chemical Industry, London. In this capacity Mr. Moore will bring to the attention of the Society's American section the papers, programs and activities of the parent group.

C. F. Rohleder

E. G. Robinson

✦ **Frank Day**, a graduate in chemistry from Ohio State University, has been appointed to the technical staff of Battelle Memorial Institute, Columbus, Ohio.

✦ **A. T. Loeffler**, for many years associated with the Hooker Electrochemical Co., is now in the New York office of the Monsanto Chemical Co.

✦ **Albert L. Galusha**, inventor of the Galusha gas generator, has become associated with the Wellman Engineering Co., Cleveland, as chief engineer in charge of its recently acquired line of Galusha gas equipment.

✦ **George M. Norman**, manager of the development department of Hercules Powder Co., has been elected to the finance committee of that organization.

✦ **Robert E. Wilson**, former vice-chairman of the boards, has been elected president of the Pan American Petroleum and Transport Co., the American Oil Co. and their subsidiaries, succeeding Jacob Blaustein, resigned.

R. E. Wilson

✦ **Charles F. Rohleder** has been appointed chief chemist of Maas and Waldstein Co., makers of industrial finishes, Newark, N. J. A graduate in chemistry from Cooper Union in 1926, he has spent all of his professional life in research and production work in the industrial finishes field.

✦ **Walter J. Baeza**, president of the Industrial Research Co. of New York, sailed April 1 for Colon, Panama Canal Zone, from where he will fly to Nicaragua to investigate a project for a British-American syndicate.

✦ **Harlan W. How**, until recently connected with the process equipment division of the Blaw-Knox Co., has rejoined the staff of Struthers Wells-Titusville Corp. as technical director of the Titusville Iron Works Co. at Titusville, Pa.

✦ **H. W. Swank**, who will receive his Ph.D. in chemistry from Purdue University in June, has accepted a position in the rayon division of E. I. du Pont de Nemours & Co. at Buffalo, N. Y.

✦ **A. F. Nelson** has resigned his research assistantship in chemistry at Harvard University to accept a position with Lever Bros. Co.

✦ **Frederick C. Oppen**, Ph.D., University of Wisconsin, 1936, is employed as research chemist at the Baton Rouge refinery of the Standard Oil Co. of Louisiana.

✦ **Maurice G. Kiser** has left the employ of Save Electric Co. to take the position of chemist at Doehler Die Casting Co.

✦ **E. J. Ramaley** has been appointed to the technical staff of Battelle Memorial Institute, Columbus, Ohio. He will be engaged in research on the magnetic properties of alloys.

✦ **E. G. Robinson**, general manager, organic chemicals department of E. I. du Pont de Nemours & Co., has been elected to the board of directors of that company to succeed the late John P. Laffey. Mr. Robinson was a member of the American delegation at the Chemical Engineering Congress in London last summer.

✦ **S. I. Aronovsky**, formerly of the Institute of Paper Chemistry, has been appointed cellulose chemist at the Agricultural Byproducts Laboratory of Iowa State University at Ames, Iowa.

✦ **A. L. Blomfield**, managing director of the Lake Shore Gold Mines Ltd., Ontario, Canada, was awarded the platinum medal of the Canadian Institute of Mining and Metallurgy at the Institute's annual meeting held at Montreal on March 16.

# OBITUARY

✦ **T. V. Blodgett**, associated with the Lebanon Steel Foundry since 1920, died March 28 at Lebanon, Pa. He was active as sales manager of the company at the time of his death.

✦ **Victor G. Bloede**, a manufacturing chemist for more than fifty years, died March 27 at Catonsville, Md. Up to the time of his death, Mr. Bloede was active head of the ink manufacturing company which bears his name.

✦ **Jacques Cavalier**, French authority on metallurgical chemistry, died March 22 as the result of injuries suffered when he was struck by a motorcycle. He was in this country in 1921 as French exchange professor and lectured on metallurgical subjects at several of our eastern universities.

# Chemical ECONOMICS and MARKETS

## CHEMICAL PRODUCTION LARGER THAN IN FIRST QUARTER OF 1936

VOLUME of industrial production in February was the largest recorded since October, 1929, according to the report of the Federal Reserve System.

The steel, automobile, textile, shoe, coal, petroleum, machinery, plate glass, chemical and transportation equipment industries contributed to the general rise in activity which carried the unadjusted index of industrial production for February to 117 per cent of the 1923-25 average, the highest figure reached in the last seven and a half years.

The adjusted index, which allows for the normal seasonal increases and similar variations, stood at 116 per cent of the 1923-25 average in February. With the exception of last December, no month since October, 1929, has seen this adjusted index at a comparable level.

Total net sales and collections showed substantial improvement during February for the group of manufacturers reporting in the monthly joint study of the National Association of Credit Men and the Bureau of Foreign and Domestic Commerce. This is a continuation of the gains in sales and higher rates of collections recorded for each month since January 1936 when compared with the corresponding month in the previous year by this group of manufacturers.

Total net sales of the 557 manufacturers reporting in February registered an increase of 25 per cent from February 1936. Without adjustment for seasonal influences, February 1937 sales registered an increase of 2.4 per cent from January of this year.

Total sales increased in February 1937 over the same month last year for all of the 15 industry groups shown in the report. The increases ranged from 4.1 per cent for printing and publishing to 65.3 per cent for non-ferrous metals and their products. The increases in February 1937 sales over February 1936 for forest products; stone, clay and glass products; motor-vehicle parts; and iron and steel and their products also were high, the increases exceeding 50 per cent.

Percentage changes in the dollar volume of manufacturers sales for February compared with January and also with February, 1936 show the following for some of the chemical and related products groupings:

| | Feb. 1937 percentage change from Feb. 1936 | Jan. 1937 |
|---|---|---|
| Textiles | 25.5 | 17.7 |
| Paper and products | 27.4 | 3.9* |
| Chemicals | 28.4 | 2.7 |
| Paint and varnish | 40.7 | 3.7* |
| Pharmaceuticals | 13.4 | 5.8 |
| Petroleum products | 5.4 | 1.8* |
| Rubber products | 45.8 | 8.9* |
| Leather and products | 28.5 | 12.9 |
| Stone, clay, and glass | 60.9 | 15.8 |
| Iron and steel | 54.9 | 0.8* |

* Percentage of decline. All other figures represent percentage of gain.

Building activities increased from January to February, according to Labor Department records, showing a rise of 33 per cent in the value of permits issued.

The increase in building permits is in line with predictions that an all time record will be created this year for the sale of paint and varnish products. Automotive production, which has been adversely affected by labor troubles, gives promise of aiding materially in the establishment of a record for the paint and varnish industry.

Production of plate and window glass has been on an expanding scale in recent weeks and while figures for plate glass output for March are not yet at hand, it is probable that a new monthly record was established. Other branches of the glass industry also have been active and consumption of chemicals in that industry—particularly soda ash—has been increased accordingly.

Based on reports that the soap, glass, textile, tanning, paint and varnish, steel and metallurgical, fertilizer, and other consuming industries operated at a higher rate in the first three months of this year as compared with the corresponding months last year it is evident that production of chemicals, so far this year, has been on a broader scale than in the opening months of 1936.

Movement of goods from producing points during the second quarter of this year is expected to increase by 7.5 per cent over that reported for the second quarter of last year. This is based on reports from the 13 Shippers' Regional Advisory Boards. The increases for the quarter over the 1936 period, as referred to the chemical and related industries show the following: salt, 6.7 per cent; petroleum and products, 5.1 per cent; fertilizer, 7 per cent; paper, paper board, and prepared roofing, 10.8 per cent; chemicals and explosives, 8.4 per cent.

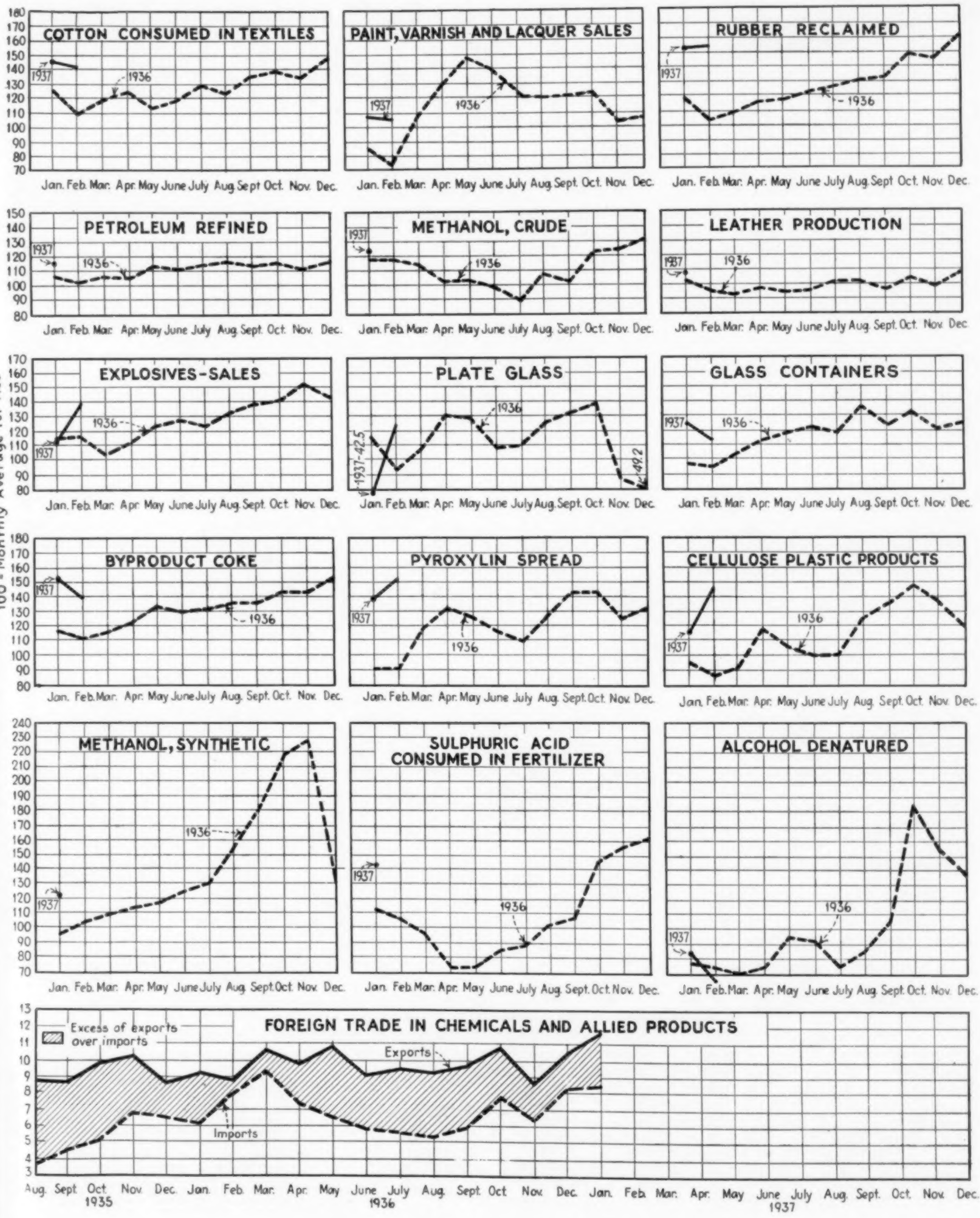
All branches of the textile industry appear to have been more active in the first quarter of this year than they were a year ago. Complete data for March are not yet available but consumption of cotton has held well above last year's level and silk deliveries, which approximate consumption, were more than 14 per cent higher than last year, the totals being 122,616 bales and 107,048 bales for 1937 and 1936 respectively.

**Production and Consumption Data for Chemical-Consuming Industries**

| PRODUCTION | Feb., 1937 | Feb., 1936 | Jan.-Feb., 1937 | Jan.-Feb., 1936 | Gain for 1937 per cent |
|---|---|---|---|---|---|
| Alcohol, denatured, 1000 wi. gal | 5,477 | 5,939 | 12,287 | 12,146 | 1.2 |
| Ammonia, tons | 63,861 | 49,734 | 133,559 | 102,154 | 30.7 |
| Automobiles, No. | 363,930 | 287,606 | 743,773 | 651,610 | 14.1 |
| Benzol, 1,000 gal | 9,522 | 7,303 | 19,891 | 15,128 | 31.5 |
| Byproduct coke, 1,000 tons | 3,991 | 3,141 | 8,349 | 6,450 | 29.4 |
| Cellulose acetate plastics, 1,000 lbs. | 1,270 | 597 | 2,123 | 1,466 | 44.8 |
| Nitrocellulose plastics, 1,000 lbs | 1,976 | 1,322 | 3,691 | 2,551 | 44.7 |
| Glass containers, 1,000 grs. | 3,880 | 3,047 | 7,919 | 6,161 | 28.5 |
| Plate glass, 1,000 sq. ft. | 18,676 | 13,857 | 25,050 | 31,133 | 19.5* |
| Methanol, crude, 1,000 gals | 525 | 494 | 1,026 | 988 | 0.4 |
| Methanol, synthetic, 1,000 gals | 1,849 | 1,540 | 3,685 | 2,959 | 24.5 |
| Pyroxylin spread, 1,000 lbs | 6,498 | 3,894 | 12,463 | 7,845 | 58.9 |
| Rosin, wood, bbls | 58,068 | 52,693 | 118,688 | 104,849 | 13.2 |
| Turpentine, wood, bbls | 9,061 | 8,740 | 18,693 | 17,782 | 5.1 |
| Rubber reclaimed, tons | 15,192 | 10,188 | 30,321 | 21,853 | 38.8 |
| **CONSUMPTION** | | | | | |
| Cotton, 1,000 bales | 664 | 516 | 1,180 | 1,106 | 6.7 |
| Silk, bales | 38,484 | 32,053 | 82,682 | 71,048 | 16.4 |
| Explosives, sales, 1,000 lbs | 28,272 | 28,825 | 56,166 | 57,317 | 2.0* |
| Rubber, crude, tons | 50,282 | 36,746 | 99,026 | 85,252 | 16.2 |
| Paint, varnish and lacquer, $1,000 | 31,016 | 21,266 | 62,304 | 45,416 | 37.2 |

* Percent of decline

# TRENDS OF PRODUCTION AND CONSUMPTION



## CHEMICALS JOIN IN UPWARD SWING OF PRICES

CHIEF interest in the market for chemicals has centered in the price movement which brought about a sharp rise in the weighted index number for the month. An analysis of factors largely responsible for the rise in values, however, does not indicate that any decided trend has set in which would result in a steadily rising curve for chemicals and related products. The sharp rise recorded for the past month was largely due to the high price levels reached by the metal salts which, in turn, were influenced by the position of the metal markets. Basic carbonate and basic sulphate of lead, lead oxides, acetate of lead, zinc oxide, zinc sulphate, zinc dust, copper sulphate, and tin oxide were prominent among the chemicals for which higher prices went into effect. The later decline in metal prices brought a readjustment in the prices for the salts.

Reports from the metal markets attribute the upward price movement to a prolonged heavy buying period on the part of European governments and European industries, partly for armament purposes, partly from the desire to build up reserve stocks, and last but by no means least, to heavy speculative buying at a time when production was well sold up and the market was especially sensitive to speculative influences.

With the exception of the metal salts, prices for chemicals were not characterized by any unusual price fluctuations. It is true that, due to inflationary considerations, a long-term trend for prices points upward but in the case of chemicals where competition is keen, it is logical to assume that any change in the present price structure will depend on changes in production costs. As the chemical industry is highly mechanized, changes in labor costs are relatively less important than are changes in the status of raw materials. Price adjustments in chemicals, therefore, will probably be dictated by the variations in costs for raw materials.

Raw materials, in turn, may be divided into three general groups: (1) Those materials—such as metals—which are subject to world market influences; (2) raw materials of foreign origin, essential to production of domestic chemicals; and (3) domestic materials which are little, if any, affected by world markets.

What has happened in the last month in the case of metal salts is typical of what may happen in the way of price changes for such chemicals as depend on this type of raw material. Our dependence on foreign raw materials has been lessened by the development of new products at home and by the growth of synthetic manufacture but the position of foreign markets will extend to this country in the case of many materials, such as pyrites, varnish gums, shellac, casein, copra, nitrate of soda, and different vegetable oils. The third group of raw materials possibly may be affected by the general trend but they should follow closely the general law of supply and demand.

Deliveries of chemicals are going forward to consuming industries in large volume although labor troubles have cut down consumption in some lines. Trade reports for the movement for the first quarter of this year were very satisfactory with the total tonnage considerably above that for the first quarter of last year. In some cases new business last month was stimulated by the anticipation of higher prices and some industries are reported to have bought heavily in recent months in order to build up inventories either of raw materials or of their own finished products.

In the market for oils, linseed oil has attracted attention because of the sharp rise in prices in the face of a forecast for a flaxseed crop in the Argentine of 1,850,000 tons which is considerably above the five-year average.

Restriction of international goods trade by Congressional action, in the effort to maintain United States neutrality, has more support in Congress than almost any other important measure.

Chemical enterprises are probably no more affected by all this than are other goods, unless the President is given full power to designate which commodities would be regulated. In other respects, with reference to citizen travel, what shipments may be held contraband, and as to participation of American enterprises in the trade, there is not likely to be important distinctions between chemical commodities and others.

Developments in foreign countries as reported to the Department of Commerce include:

Production of alcohol in the Philippines has increased over five fold since 1922 when 11 million proof liters were distilled compared with 69 million last year. Formerly alcohol in the Philippines was produced largely from palm juices, but in recent years modernized distilleries have turned to molasses, a byproduct of the sugar industry, for their raw material. Large quantities of alcohol are used in the Philippines as motor fuel.

While Brazil's output of carnauba wax, a base material used in the manufacture of polishes, was about the same last year as in 1935—10,000 metric tons—keener foreign demand resulted in a 40 per cent increase in quotations during the year. The United States is the leading foreign market for this product, with which Brazil has a monopoly.

Although considerable attention has been given in Chile to increasing the country's sulphur output, production last year remained at around the normal annual of 20,000 metric tons, according to reports from Santiago.

### CHEM. & MET.
### Weighted Index of CHEMICAL PRICES

Base=100 for 1927

| | |
|---|---|
| This month | 88.38 |
| Last month | 87.79 |
| April, 1936 | 86.67 |
| April, 1935 | 87.53 |

The price trend was sharply upward last month with lead carbonate, zinc oxide, acetic acid, copper sulphate, tartaric acid, and tin oxide prominent on the up side. Lead oxides sold off from the high levels reached in March.

Chemical ECONOMICS and MARKETS

### CHEM. & MET.
### Weighted Index of Prices for OILS AND FATS

Base=100 for 1927

| | |
|---|---|
| This month | 112.10 |
| Last month | 108.84 |
| April, 1936 | 87.01 |
| April, 1935 | 94.47 |

Higher prices were fairly general throughout the vegetable oil list. Linseed oil was quoted at a full cent a pound above the price of a month ago. Coconut oil ran counter to the general trend. Animal fats also were higher.

# Current PRICES

## INDUSTRIAL CHEMICALS

| | Current Price | Last Month | Last Year |
|---|---|---|---|
| Acetone, drums, lb | $0.07 -$0.08 | $0.07 -$0.08 | $0.9½ -$0.10 |
| Acid, acetic, 28%, bbl., cwt | 2.45 - 2.70 | 2.25 - 2.50 | 2.45 - 2.70 |
| Glacial 99%, drums | 8.43 - 8.68 | 8.43 - 8.68 | 8.43 - 8.68 |
| U. S. P. reagent | 10.52 -10.77 | 10.52 -10.77 | 10.52 -10.77 |
| Boric, bbl., ton | 105.00-115.00 | 105.00-115.00 | 105.00-115.00 |
| Citric, kegs, lb | .25 - .28 | .25 - .28 | .27 - .30 |
| Formic, bbl., ton | .11 - .11½ | .11 - .11½ | .11 - .11½ |
| Gallic, tech., bbl., lb | .60 - .65 | .60 - .65 | .60 - .65 |
| Hydrofluoric 30% carb., lb | .07 - .07½ | .07 - .07½ | .07 - .07½ |
| Lactic, 44%, tech. light, bbl., lb | .06½- .06¾ | .06½- .06¾ | .11½- .12 |
| Muriatic, 18°, tanks, cwt | 1.00 - 1.10 | 1.00 - 1.10 | 1.00 - 1.10 |
| Nitric, 36°, carboys, lb | .05 - .05½ | .05 - .05½ | .05 - .05½ |
| Oleum, tanks, wks., ton | 18.50 -20.00 | 18.50 -...... | 18.50 -20.00 |
| Oxalic, crystals, bbl., lb | .10¾- .12 | .10¾- .12 | .11¼- .12¾ |
| Phosphoric, tech., c'bys., lb | .09 - .10 | .09 - .10 | .09 - .10 |
| Sulphuric, 60°, tanks, ton | 11.00 -11.50 | 11.00 -11.50 | 11.00 -11.50 |
| Sulphuric, 66°, tanks, ton | 15.50 -...... | 15.50 -...... | 15.50 -...... |
| Tannic, tech., bbl., lb | .26 - .30 | .26 - .30 | .23 - .35 |
| Tartaric, powd., bbl., lb | .22¾- .23¾ | .21¾- .22¾ | .24 - .25 |
| Tungstic, bbl., lb | 2.50 - 2.75 | 2.50 - 2.75 | 1.50 - 1.60 |
| Alcohol, Amyl | ......-...... | ......-...... | ......-...... |
| From Pentane, tanks, lb | .123 -...... | .123 -...... | .15 -...... |
| Alcohol, Butyl, tanks, lb | .08½-...... | .08½-...... | .09½-...... |
| Alcohol, Ethyl, 190 p'f., bbl., gal | 4.14 -...... | 4.14 -...... | 4.27½-...... |
| Denatured, 190 proof | | | |
| No. 1 special, dr., gal wks | .32 -...... | .32 -...... | .33 -...... |
| Alum, ammonia, lump, bbl., lb | .03 - .04 | .03 - .04 | .03 - .04 |
| Potash, lump, bbl., lb | .03 - .04 | .03 - .04 | .03 - .04 |
| Aluminum sulphate, com bags cwt | 1.35 - 1.50 | 1.35 - 1.50 | 1.35 - 1.50 |
| Iron free, bg., cwt | 2.00 - 2.25 | 2.00 - 2.25 | 2.00 - 2.25 |
| Aqua ammonia, 26°, drums, lb | .02½- .03 | .02½- .03 | .02½- .03 |
| tanks, lb | .02½- .02¾ | .02½- .02¾ | .02½- .02¾ |
| Ammonia, anhydrous, cyl., lb | .15½- .16 | .15½- .16 | .15½- .16 |
| tanks, lb | .04½-...... | .04½-...... | .04½-...... |
| Ammonium carbonate, powd. tech., casks, lb | .08 - .12 | .08 - .12 | .08 - .12 |
| Sulphate, wks., cwt | 1.35 -...... | 1.35 -...... | 1.25 -...... |
| Amylacetate tech., tanks, lb | .11 - .11½ | .11 - .11½ | .12 -...... |
| Antimony Oxide, bbl., lb | .16 - .16½ | .16 - .16½ | .13½- .14 |
| Arsenic, white, powd., bbl., lb | .03 - .03½ | .03 - .03½ | .03½- .04 |
| Red, powd., kegs, lb | .15½- .16 | .15½- .16 | .15½- .16 |
| Barium carbonate, bbl., ton | 56.50 -58.00 | 56.50 -58.00 | 56.50 -58.00 |
| Chloride, bbl., ton | 72.00 -74.00 | 72.00 -74.00 | 72.00 -74.00 |
| Nitrate, cask, lb | .08½- .09 | .08½- .09 | .08½- .09 |
| Blanc fixe, dry, bbl., lb | .03½- .04 | .03½- .04 | .03½- .04 |
| Bleaching powder, f.o.b., wks., drums, cwt | 2.00 - 2.10 | 2.00 - 2.10 | 2.00 - 2.10 |
| Borax, gran., bags, ton | 44.00 -49.00 | 44.00 -49.00 | 44.00 -49.00 |
| Bromine, cs., lb | .36 - .38 | .36 - .38 | .36 - .38 |
| Calcium acetate, bags | 2.10 -...... | 2.10 -...... | 2.10 -...... |
| Arsenate, dr., lb | .06½- .07 | .06½- .07 | .06 - .07 |
| Carbide drums, lb | .05 - .06 | .05 - .06 | .05 - .06 |
| Chloride, fused, dr., del., ton | 20.00 -33.00 | 20.00 -33.00 | 20.00 -33.00 |
| flake, dr., del., ton | 22.00 -35.00 | 22.00 -35.00 | 22.00 -35.00 |
| Phosphate, bbl., lb | .07½- .08 | .07½- .08 | .07½- .08 |
| Carbon bisulphide, drums, lb | .05½- .06 | .05½- .06 | .05½- .06 |
| Tetrachloride drums, lb | .05½- .08½ | .05½- .06 | .05½- .06 |
| Chlorine, liquid, tanks, wks., lb | 2.15 -...... | 2.15 -...... | 2.15 -...... |
| Cylinders | .05½- .06 | .05½- .06 | .05½- .06 |
| Cobalt oxide, cans, lb | 1.41 - 1.51 | 1.41 - 1.51 | 1.29 - 1.35 |
| Copperas, bgs., f.o.b., wks., ton | 15.00 -16.00 | 15.00 -16.00 | 15.00 -16.00 |
| Copper carbonate, bbl., lb | .11½- .19½ | .11½- .19 | .11½- .16 |
| Sulphate, bbl., cwt | 6.00 - 6.25 | 5.65 - 5.90 | 3.85 - 4.00 |
| Cream of tartar, bbl., lb | .15¾- .16¼ | .15 - .15½ | .16¾- .17 |
| Diethylene glycol, dr., lb | .16½- .20½ | .16½- .20½ | .16½- .20½ |
| Epsom salt, dom., tech., bbl., cwt | 1.80 - 2.00 | 1.80 - 2.00 | 1.80 - 2.00 |
| Ethyl acetate, drums, lb | .07 -...... | .07 -...... | .07½-...... |
| Formaldehyde, 40%, bbl., lb | .05¾- .06¼ | .05¾- .06¼ | .06 - .07 |
| Furfural, dr., lb | .10 - .17½ | .10 - .17½ | .10 - .17½ |
| Fusel oil, ref. drums, lb | .16 - .18 | .16 - .18 | .16 - .18 |
| Glaubers salt, bags, cwt | .85 - 1.00 | .85 - 1.00 | .85 - 1.00 |
| Glycerine, c.p., drums, extra, lb | .31 -...... | .31 -...... | .14½- .15 |
| Lead: | | | |
| White, basic carbonate, dry casks, lb | .07½-...... | .09 -...... | .06½-...... |
| White, basic sulphate, sck., lb | .07½-...... | .08½-...... | .06 -...... |
| Red, dry, sck, lb | .08½-...... | .10 -...... | .07 -...... |
| Lead acetate, white crys., bbl., lb | .13½- .14 | .11½- .12 | .10½- .11 |
| Lead arsenate, powd., bbl., lb | .11½- .12 | .10½- .11 | .09 - .10 |
| Lime, chem., bulk, ton | 8.50 -...... | 8.50 -...... | 8.50 -...... |
| Litharge, pwd., csk., lb | .07½-...... | .09 -...... | .06 -...... |
| Lithophone, bags, lb | .04½- .04¾ | .04½- .04¾ | .04½- .05 |
| Magnesium carb., tech., bags, lb | .06 - .06½ | .06 - .06½ | .06 - .06½ |

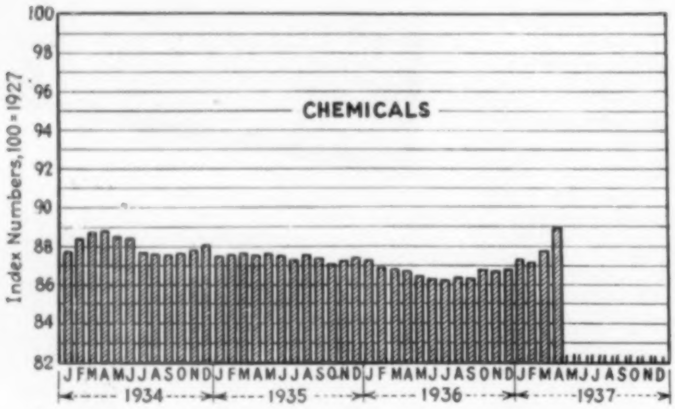
The accompanying prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to April 13

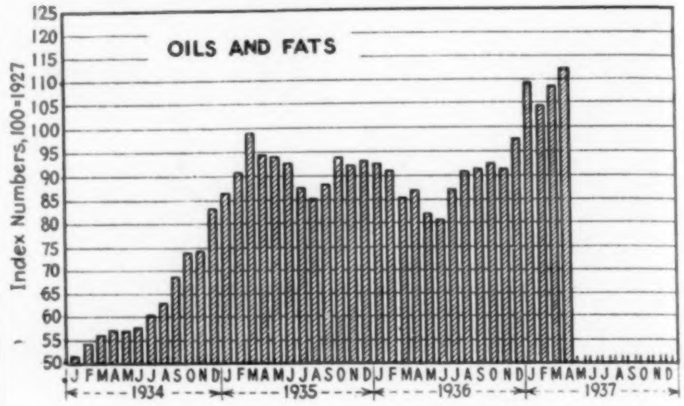
| | Current Price | Last Month | Last Year |
|---|---|---|---|
| Methanol, 95%, tanks, gal | .33 -...... | .33 -...... | .33 -...... |
| 97%, tanks, gal | .34 -...... | .34 -...... | .34 -...... |
| Synthetic, tanks, gal | .33 -...... | .35½-...... | .35½-...... |
| Nickel salt, double, bbl., lb | .13 - .13½ | .13 - .13½ | .13 - .13½ |
| Orange mineral, csk., lb | .11½-...... | .13 -...... | .10 -...... |
| Phosphorus, red, cases, lb | .40 - .42 | .40 - .42 | .44 - .45 |
| Yellow, cases, lb | .24 - .30 | .28 - .32 | .28 - .32 |
| Potassium bichromate, casks, lb | .08½- .09 | .08½- .09 | .08½- .09 |
| Carbonate, 80-85%, calc. csk., lb | .07 - .07½ | .07 - .07½ | .07 - .07½ |
| Chlorate, powd., lb | .08½- .09 | .08½- .09 | .08 - .08½ |
| Hydroxide (c'stic potash) dr., lb | .07 - .07½ | .07 - .07½ | .06½- .06½ |
| Muriate, 80% bgs., ton | 23.00 -...... | 23.00 -...... | 22.00 -...... |
| Nitrate, bbl., lb | .05½- .06 | .05½- .06 | .05½- .06 |
| Permanganate, drums, lb | .18½- .19 | .18½- .19 | .18½- .19 |
| Prussiate, yellow, casks, lb | .15 - .16 | .15 - .16 | .18 - .19 |
| Sal ammoniac, white, casks, lb | .05 - .05½ | .04½- .05 | .04½- .05 |
| Salsoda, bbl., cwt | 1.00 - 1.05 | 1.00 - 1.05 | 1.00 - 1.05 |
| Salt cake, bulk, ton | 13.00 -15.00 | 13.00 -15.00 | 13.00 -15.00 |
| Soda ash, light, 58%, bags, contract, cwt | 1.23 -...... | 1.23 -...... | 1.23 -...... |
| Dense, bags, cwt | 1.25 -...... | 1.25 -...... | 1.25 -...... |
| Soda, caustic, 76%, solid, drums, contract, cwt | 2.60 - 3.00 | 2.60 - 3.00 | 2.60 - 3.00 |
| Acetate, works, bbl., lb | .04½- .05 | .04½- .05 | .04½- .05 |
| Bicarbonate, bbl., cwt | 1.75 - 2.00 | 1.75 - 2.00 | 1.85 - 2.00 |
| Bichromate, casks, lb | .06¾- .07 | .06¾- .07 | .06½- .07 |
| Bisulphate, bulk, ton | 15.00 -16.00 | 15.00 -16.00 | 15.00 -16.00 |
| Bisulphite, bbl., lb | .03½- .04 | .03½- .04 | .03 - .04 |
| Chlorate, kegs, lb | .06½- .06½ | .06½- .06½ | .06½- .06½ |
| Chloride, tech., ton | 12.00 -14.75 | 12.00 -14.75 | 12.00 -14.75 |
| Cyanide, cases, dom., lb | .16½- .17 | .15½- .16 | .15½- .16 |
| Fluoride, bbl., lb | .07½- .08 | .07½- .08 | .07½- .08 |
| Hyposulphite, bbl., cwt | 2.40 - 2.50 | 2.40 - 2.50 | 2.40 - 2.50 |
| Metasilicate, bbl., cwt | 2.15 - 3.15 | 2.15 - 3.15 | 2.90 - 3.00 |
| Nitrate, bags, cwt | 1.375-...... | 1.375-...... | 1.325-...... |
| Nitrite, casks, lb | .07½- .08 | .07½- .08 | .07½- .08 |
| Phosphate, dibasic, bbl., lb | .022- .023 | .022- .023 | .022- .024 |
| Prussiate, yel. drums, lb | .10 - .11 | .10 - .11 | .11½- .12 |
| Silicate (40° dr.) wks., cwt | .80 - .85 | .80 - .85 | .80 - .85 |
| Sulphide, fused, 60-62%, dr., lb | .02¾- .03½ | .02¾- .03 | .02¾- .03 |
| Sulphite, crys., bbl., lb | .02½- .02½ | .02½- .02½ | .02½- .02½ |
| Sulphur, crude at mine, bulk, ton | 18.00 -...... | 18.00 -...... | 18.00 -...... |
| Chloride, dr., lb | .03½- .04 | .03½- .04 | .03½- .04 |
| Dioxide, cyl., lb | .07 - .08 | .06½- .08 | .07 - .07½ |
| Flour, bag, cwt | 1.60 - 3.00 | 1.60 - 3.00 | 1.60 - 3.00 |
| Tin Oxide, bbl., lb | .58 -...... | .58 -...... | .51 -...... |
| Crystals, bbl., lb | .42½-...... | .44 -...... | .37½-...... |
| Zinc, chloride, gran., bbl., lb | .05 - .06 | .05 - .06 | .05 - .06 |
| Carbonate, bbl., lb | .14 - .15 | .12 - .13 | .09 - .11 |
| Cyanide, dr., lb | .36 - .38 | .36 - .38 | .36 - .38 |
| Dust, bbl., lb | .094- .07 | .087- .07 | .069- .07 |
| Zinc oxide, lead free, bag., lb | .05½-...... | .05½-...... | .05 -...... |
| 5% lead sulphate, bags, lb | .05½-...... | .05½-...... | .04½-...... |
| Sulphate, bbl., cwt | 3.30 - 4.50 | 2.65 - 3.00 | 2.65 - 3.00 |

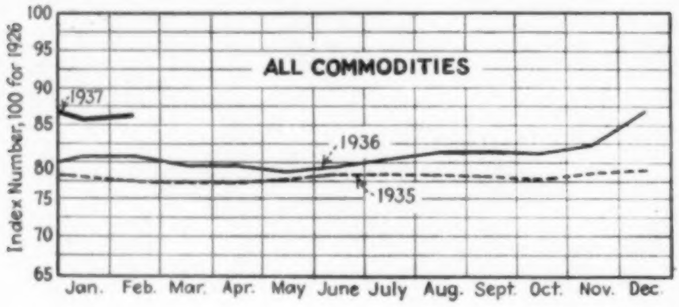
## OILS AND FATS

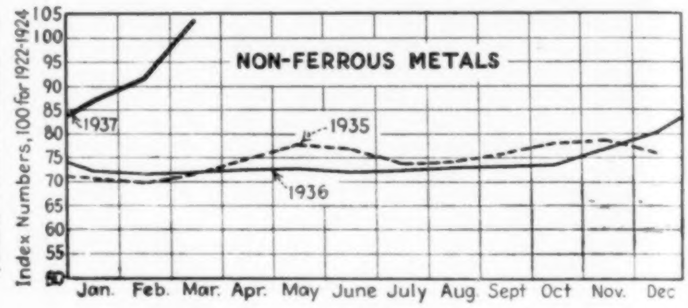
| | Current Price | Last Month | Last Year |
|---|---|---|---|
| Castor oil, No. 3, bbl., lb | $0.10½-$0.11 | $0.10½-$0.11 | $0.10 -$0.11 |
| Chinawood oil, bbl., lb | .15¾-...... | .15¾-...... | .19 -...... |
| Coconut oil, Ceylon, tanks, N. Y. lb | .08½-...... | .09 -...... | .04½-...... |
| Corn oil crude, tanks, (f.o.b. mill), lb | .10½-...... | .10 -...... | .08¾-...... |
| Cottonseed oil, crude (f.o.b. mill), tanks, lb | .09¾ ...... | .09¾-...... | .08½-...... |
| Linseed oil, raw car lots, bbl., lb | .113 ...... | .101-...... | .096-...... |
| Palm, casks, lb | .07 -...... | .06½-...... | .04½-...... |
| Peanut oil, crude, tanks (mill), lb | .10¼-...... | .10¼ ...... | .08¾-...... |
| Rapeseed oil, refined, bbl., gal | .90 -...... | .87 -...... | .53 -...... |
| Soya bean, tank, lb | .10 -...... | .10 -...... | .08 -...... |
| Sulphur (olive foots), bbl., lb | .12 -...... | .12½-...... | .08 -...... |
| Cod, Newfoundland, bbl., gal | .51 -...... | .51 -...... | .40 -...... |
| Menhaden, light pressed, bbl., lb | .09 -...... | .088-...... | .066-...... |
| Crude, tanks (f.o.b.factory), gal | .45 -...... | .40 -...... | .34 -...... |
| Grease, yellow, loose, lb | .08½-...... | .08½-...... | .04¾-...... |
| Oleo stearine, lb | .10¼-...... | .10¼-...... | .08 -...... |
| Red oil, distilled, d.p. bbl., lb | .10½-...... | .10½-...... | .09½-...... |
| Tallow, extra, loose, lb | .09 -...... | .08½-...... | .05½-...... |

# CHEM. & MET.'S WEIGHTED PRICE INDEXES




## COAL-TAR PRODUCTS

| | Current Price | Last Month | Last Year |
|---|---|---|---|
| Alpha-napthol, crude, bbl., lb | $0.52 -$0.55 | $0.55 -$0.60 | $0.60 -$0.62 |
| Alpha-napthylamine, bbl., lb | .32 - .34 | .32 - .34 | .32 - .34 |
| Aniline oil, drums, extra, lb | .15 - .16 | .15 - .16 | .14½- .15 |
| Aniline salts, bbl., lb | .24 - .25 | .24 - .25 | .24 - .25 |
| Benzaldehyde, U.S.P., dr., lb | 1.10 - 1.25 | 1.10 - 1.25 | 1.10 - 1.25 |
| Benzidine base, bbl., lb | .65 - .67 | .65 - .67 | .65 - .67 |
| Benzoic acid, U.S.P., kgs., lb | .52 - .54 | .52 - .54 | .48 - .52 |
| Benzyl chloride, tech., dr., lb | .25 - .26 | .25 - .26 | .30 - .35 |
| Benzol, 90%, tanks, works, gal | .16 - .18 | .16 - .18 | .18 - .20 |
| Beta-napthol, tech., drums, lb | .23 - .24 | .23 - .24 | .24 - .27 |
| Cresol, U.S.P., dr., lb | .10 - .11 | .10 - .11 | .11 - .11½ |
| Cresylic acid, 99%, dr., wks., gal | .77 - .85 | .73 - .75 | .58 - .60 |
| Diethylaniline, dr., lb | .55 - .58 | .55 - .58 | .55 - .58 |
| Dinitrophenol, bbl., lb | .23 - .25 | .23 - .25 | .29 - .30 |
| Dinitrotoluen, bbl., lb | .15 - .16 | .15 - .16 | .16 - .17 |
| Dip oil, 25%, dr., gal | .23 - .25 | .23 - .25 | .23 - .25 |
| Diphenylamine, bbl., lb | .32 - .36 | .32 - .36 | .38 - .40 |
| H-acid, bbl., lb | .50 - .55 | .55 - .60 | .65 - .70 |
| Naphthalene, flake, bbl., lb | .07½- .07¾ | .07½- .07¾ | .07 - .08 |
| Nitrobenzene, dr., lb | .08½- .09 | .08½- .09 | .08½- .10 |
| Para-nitraniline, bbl., lb | .45 - .47 | .45 - .47 | .51 - .55 |
| Phenol, U.S.P., drums, lb | .13½- .14 | .13½- .14 | .14½- .15 |
| Picric acid, bbl., lb | .30 - .40 | .30 - .40 | .30 - .40 |
| Pyridine, dr., gal | 1.30 - 1.35 | 1.10 - 1.15 | 1.10 - 1.15 |
| Resorcinal, tech., kegs, lb | .75 - .80 | .70 - .75 | .65 - .70 |
| Salicylic acid, tech., bbl., lb | .34 - .40 | .34 - .40 | .40 - .42 |
| Solvent naptha, w.w., tanks, gal | .30 -...... | .26 -...... | .26 -...... |
| Tolidine, bbl., lb | .88 - .90 | .88 - .90 | .88 - .90 |
| Toluene, tanks, works, gal | .35 -...... | .30 -...... | .30 -...... |
| Xylene, com., tanks, gal | .35 -...... | .30 -...... | .30 -...... |

## MISCELLANEOUS

| | Current Price | Last Month | Last Year |
|---|---|---|---|
| Barytes, grd., white, bbl., ton | $22.00-$25.00 | $22.00-$25.00 | $22.00-$25.00 |
| Casein, tech., bbl., lb | .16 - .18 | .18¾- .20 | .14½- .16 |
| China clay, dom., f.o.b. mine, ton | 8.00 -20.00 | 8.00 -20.00 | 8.00 -20.00 |
| Dry colors: | | | |
| Carbon gas, black (wks.), lb | .04 - .20 | .04 - .20 | .04 - .20 |
| Prussian blue, bbl., lb | .37 - .38 | .37 - .38 | .37 - .38 |
| Ultramarine blue, bbl., lb | .10 - .26 | .10 - .26 | .10 - .26 |
| Chrome green, bbl., lb | .26 - .27 | .26 - .27 | .26 - .27 |
| Carmine red, tins, lb | 4.00 - 4.40 | 4.00 - 4.40 | 4.00 - 4.40 |
| Para toner, lb | .75 - .80 | .75 - .80 | .80 - .85 |
| Vermilion, English, bbl., lb | 1.72 - 1.75 | 1.72 - 1.75 | 1.59 - 1.60 |
| Chrome yellow, C. P., bbl., lb | .13 - .14 | .13 - .14 | .12 - .14 |
| Feldspar, No. 1 (f.o.b. N.C.), ton | 6.50 - 7.50 | 6.50 - 7.50 | 6.50 - 7.50 |
| Graphite, Ceylon, lump, bbl., lb | .06 - .06½ | .07 - .08½ | .07 - .08½ |
| Gum copal Congo, bags, lb | .08 - .30 | .08 - .30 | .08 - .30 |
| Manila, bags, lb | .08¾- .14 | .08¾- .14 | .08¾- .14 |
| Damar, Batavia, cases, lb | .15¼- .23 | .13½- .16 | .15½- .16 |
| Kauri cases, lb | .17½- .60 | .17½- .60 | .20 - .25 |
| Kieselguhr (f.o.b. N. Y.), ton | 50.00 -55.00 | 50.00 -55.00 | 50.00 -55.00 |
| Magnesite, calc, ton | 50.00 -...... | 50.00 -...... | 50.00 -...... |
| Pumice stone, lump, bbl., lb | .05 - .07 | .05 - .08 | .05 - .07 |
| Imported, casks, lb | .03 - .40 | .03 - .40 | .03 - .35 |
| Rosin, H., bbl | 9.30 -...... | 10.60 -...... | 5.70 -...... |
| Turpentine, gal | .41 -...... | .46 -...... | .43 -...... |
| Shellac, orange, fine, bags, lb | .25 -...... | .25 -...... | .25 -...... |
| Bleached, bonedry, bags, lb | .21 -...... | .21 -...... | .19 -...... |
| T. N. bags, lb | .14 -...... | .14 -...... | .14½-...... |
| Soapstone (f.o.b. Vt.), bags, ton | 10.00 -12.00 | 10.00 -12.00 | 10.00 -12.00 |
| Talc, 200 mesh (f.o.b. Vt.), ton | 8.00 - 8.50 | 8.00 - 8.50 | 8.00 - 8.50 |
| 300 mesh (f.o.b. Ga.), ton | 7.50 -10.00 | 7.50 -10.00 | 7.50 -11.00 |
| 225 mesh (f.o.b. N. Y.), ton | 13.75 -...... | 13.75 -...... | 13.75 -...... |

## INDUSTRIAL NOTES

WITCO CARBON CO., New York, which was formed last year to produce carbon black, has changed its name to Continental Carbon Co.

NEW YORK QUININE & CHEMICAL CO., Brooklyn, N. Y., has moved its St. Louis office to 913 Market St

FOOTE BROS. GEAR AND MACHINE CORP., Chicago, announces the following changes in sales personnel: E. G. Akridge is appointed representative in the Detroit territory succeeding Thomas Lord, resigned; F. A. Emmons, Jr. takes over the territory vacated by Mr. Akridge and Harry Harrison has been appointed sales engineer in the central territory in Chicago.

FOSTER WHEELER CORP., New York, has appointed Howard B. Hall as regional director in charge of its Cleveland, Cincinnati, and Pittsburgh territories.

A. F. HOLDEN CO., New Haven, Conn., has appointed Frank J. Enright as director of sales and advertising.

THE WATSON-STILLMAN CO., Roselle, N. J., has opened a sales office at 83 High St., Columbus, Ohio with John C. Grindley in charge. Richard W. Dinzl has been appointed chief engineer of the company with headquarters at the main office.

ELLIOTT COMPANY, Jeannette, Pa., has acquired exclusive right to manufacture and sell electrically heated apparatus developed by National Electric Heating Co.

GENERAL REFRACTORIES CO., Philadelphia, has appointed H. W. Porter & Co., as distributor in the Newark, N. J. territory.

ROOTS-CONNERSVILLE BLOWER CORP., Connersville, Ind., announces that J. B. Trotman is now acting as manager of its "T" pump division.

E. I. DU PONT DE NEMOURS & CO., Wilmington, Del., has appointed Edward A. Orem sales manager of acids and heavy chemicals for the Grasselli division.

# New CONSTRUCTION

## PROPOSED WORK

**Factory**—Celluweld Corp. of America, c/o Board of Trustees, Irvington, N. Y., has purchased a factory at Irvington and plans to alter and equip same for its own use. Estimated cost will exceed $40,000.

**Factory**—G. D. Willits Co., Salladasburg, Pa., plans to construct a 2 story, 48x96 ft. factory for the manufacture of medicines. Estimated cost $40,000.

**Gas Plant**—Wisconsin Gas & Electric Co., 4805 South Packard Ave., Milwaukee, Wis., plans improvements to its gas plant at Racine, Wis. Estimated cost $400,000.

**Glass Factory**—Corning Glass Works, Walnut St., Corning, N. Y., plans to construct a factory in or near Olean, N. Y. Estimated cost $55,000.

**Glass Factory**—Porter Mirror Glass Co., Fort Smith, Ark., contemplates the construction of a plate glass plant. Estimated cost will exceed $50,000.

**Kiln**—Hales & Hunter, 4600 Cortland Ave., Chicago, Ill., are receiving bids for the construction of a 3 story addition to their kiln. Griesser & Son, 64 West Randolph St., Chicago, Archts. Estimated cost will exceed $40,000.

**Laboratory**—Board of Affairs, Oklahoma City, Okla., plans to construct a laboratory building at the Agricultural & Mechanical College at Stillwater, Okla. Estimated cost $500,000.

**Laboratory**—Brown University, Henry M. Wriston, Pres., Providence, R. I., contemplates the construction of an electro-chemistry and photochemistry laboratory. Estimated cost $500,000.

**Refinery**—Golden Smelting & Refining Co., Golden, Colo., contemplates the construction of a 100 ton capacity smelting and refining plant, consisting of a 2 story, 48x72 ft. smelter building, 30x100 ft. sampler building, pulp room, office building, etc.

## CONTRACTS AWARDED

**Chemical Plant**—Ansul Chemical Co., Modesto, Calif., has awarded the contract for an addition to its plant to Wieland Bros., 401 Virginia Ave., Modesto. Estimated cost $20,000.

**Chemical Factory**—Clemmensen Chemical Corp., Newark, N. Y., is building a chemical factory with its own forces. Estimated cost including equipment will exceed $40,000.

**Chemical Factory**—Grasselli Chemical Co., A. Young, Chief Engr., Independence Rd., Cleveland, O., has awarded the contract for an addition to its factory to Hunkin-Conkey Construction Co., 1740 East 12th St., Cleveland. $50,000.

**Chemical Factory**—McGean Chemical Co., Republic Bldg., Cleveland, O., has awarded the contract for three factory buildings to Sam Emerson Co., 1836 Euclid Ave., Cleveland. $50,000.

**Factory**—American Cyanamid & Chemical Corp., 30 Rockefeller Plaza, New York, N. Y., has awarded the contract for a factory building at Bridgeville, Pa., to Martin & Nettrour Co., Diamond Bank Bldg., Pittsburgh, Pa.

**Factory**—Commercial Alcohols, Ltd., 3176 Notre Dame St., E., Montreal, Que., Can., has awarded the contract for an addition to its factory to Sutherland Construction Co., Ltd., 1440 Ste. Catherine St., W., Montreal, Que. Estimated cost $56,000.

**Factory**—Viscose Co., c/o R. H. Crewdson, Marcus Hook, Pa., has awarded the contract for an addition to its factory to W. D. Steinbachs Sons, Lewistown, Pa. Estimated cost $200,000.

**Factory**—Waxide Paper Co., M. W. Denebeim, Mgr., 1525 South Newstead Ave., St. Louis, Mo., has awarded the contract for an addition to its factory to George Moeller Construction Co., 3007 Wyoming St., St. Louis.

**Fertilizer Plant**—Eastern States Farmers Exchange, 666 Summer St., Boston, Mass., has awarded the contract for a fertilizer plant at Concord Ave. and Smith Pl., Cambridge, Mass., to M. Spinelli & Sons, 38 Chauncy St., Boston. Estimated cost $500,000.

**Glass Factory**—Duplate Corp., Creighton, Pa., is building a glass factory at Works 18, with company forces. Estimated cost $225,000.

**Glass Factory**—Naugatuck Glass Co., Bridge and Church Sts., Naugatuck, Conn., has awarded the contract for the construction of a factory to W. J. Megin, Inc., 51 Elm St., Naugatuck, Conn. Estimated cost $40,000.

**Glass Factory**—Owens-Illinois Glass Co., Huntington, W. Va., has awarded the contract for rebuilding its entire manufacturing section to Hughes-Foulkrod Co., Schaff Bldg., Philadelphia, Pa. Estimated cost $250,000.

**Laboratory**—California Institute of Technology, 1201 East California St., Pasadena, Calif., has awarded the contract for the construction of four laboratory buildings to W. C. Crowell, 495 East B'way., Pasadena. Estimated cost $1,300,000.

**Laboratories**—Bridgeport Brass Co., Housatonic Ave., Bridgeport, Conn., has awarded the contract for a rolling mill to include metallurgical and chemical laboratories to Stone & Webster Engineering Corp., 90 Broad St., New York, N. Y. Total estimated cost of project $4,000,000.

**Laboratory**—Columbia Alkali Co., Barberton, O., has awarded the contract for the construction of a laboratory and office to Carmichael Construction Co., 148 East Miller Ave., Cleveland. Estimated cost $100,000.

**Laboratory**—Crown Can Co., c/o Crown Cork & Seal Co., Eastern Ave. and McKesson St., Baltimore, Md., has awarded the contract for the first unit of a factory to include field laboratory and research department, at 5622 Natural Bridge Ave., St. Louis, Mo., to Consolidated Engineering Co., 20 East Franklin St., Baltimore. Total estimated cost of project $3,500,000.

**Laboratory**—Chris Hanson Laboratory, Little Falls, N. Y., has awarded the contract for the construction of a laboratory to Austin Co., 16112 Euclid Ave., Cleveland, O. Estimated cost $200,000.

**Oil Refinery**—Barnsdall Oil Co., Petroleum Bldg., Tulsa, Okla., has awarded the contract for the construction of an oil refinery at Corpus Christi, Tex., to Frick-Reid Co., Tulsa, Okla. Estimated cost $750,000.

**Oil Cracking Plant**—Sunray Oil Co., Tulsa, Okla., has awarded the contract for an oil cracking unit to Arthur G. McKee Co., 2422 Euclid Ave., Cleveland, O. Estimated cost will exceed $40,000.

**Gasoline Plant**—Texas Co., 929 South B'way, Los Angeles, Calif., has awarded the contract for a gasoline plant 5 mi. south of Fillmore, Calif., to Fluor Corp., 909 East 59th St., Los Angeles. Estimated cost $40,000.

**Pharmaceutical Products Factory**—Eli Lilly & Co., J. K. Lilly, Pres., 740 South Alabama St., Indianapolis, Ind., has awarded the contract for the construction of a factory for the manufacture of pharmaceutical products to Leslie Colvin, 823 Electric Bldg., Indianapolis. Estimated cost $300,000.

**Pharmaceutical Products Factory**—Mead-Johnson Co., St. Joseph Ave., Evansville, Ind., has awarded the contract for an addition to its plant for the manufacture of pharmaceuticals to M. J. Hoffman Construction Co., Central Union Bldg., Evansville. Estimated cost $150,000.

**Paper Mill**—Kalamazoo Vegetable Parchment Co., Kalamazoo, Mich., has awarded the contract for a 2 story 94x529 ft. mill to M. C. Billingham, Kalamazoo. Estimated cost $200,000.

**Plant**—Plant Rubber & Asbestos Co., Chestnut Dr., Redwood City, Calif., will construct an addition to its plant on Harbor Rd., Redwood City. Work will be done by day labor. Estimated cost excluding equipment $30,000.

**Rayon Factory**—Franklin Rayon Corp., 86 Crary St., Providence, R. I., has awarded the contract for a 1 story, 30x74 ft. factory to A. F. Smiley Construction Co., 202 Oak Hall Bldg., Pawtucket, R. I.

**Research Building**—Gulf Oil Corp., Gulf Bldg., Pittsburgh, Pa., has awarded the contract for a 1 story, 71x181 ft. research building at Harmarville, Pa., to D. T. Riffle, 1006 Forbes St., Pittsburgh, Pa.

**Rubber Factory**—Dayton Rubber Manufacturing Co., West Riverview Ave., Dayton, O., has awarded the contract for the construction of a factory to B. G. Davis Co., 1530 East First St., Dayton. Estimated cost $100,000.

**Soap Factory**—Dubois Soap Co., 1120 West Front St., Cincinnati, O., has awarded the contract for the construction of a soap factory to Ben Schaefer, 215 Race St., Cincinnati. Estimated cost $40,000.

**Soap Factory**—Green Bay Soap Co., Green Bay, Wis., will construct an addition to its factory. Work will be done by day labor. Estimated cost $75,000.

**Tallow Factory**—Darling & Co., manufacturer of tallow and grease, Jennings and Valley Rds., Cleveland, O., has awarded the contract for three factory buildings to Hadlock-Krill Co., 2169 East 33rd St., Cleveland. Estimated cost $50,000.

**Varnish Factory**—Lilly Varnish Co., 666 South California St., Indianapolis, Ind., has awarded the contract for 4 story, 36x42 ft. addition to its factory to Michaelis & McCahill, Inc., 542 Massachusetts Ave., Indianapolis.

**Tunnel Kiln**—Pope-Gosser China Co., Coshocton, O., has awarded the contract for the construction of a tunnel kiln to Ladd Cronin Engineering Co., Minerva, O. Estimated cost $33,000.

**Tire Factory**—Ford Motor Co., 3674 Schaefer Rd., Dearborn, Mich., has awarded the contract for structural steel for 1 and 2 story, 45,000 sq. ft. floor space, factory for the manufacture of automobile tires, to Whitehead & Kales Co., Haltner St. and West Jefferson Ave., Detroit. Total estimate of building $1,200,000. Tire making equipment, including 300 double presses, has been awarded to National Rubber Machinery Co., 917 Sweetzer Ave., Akron, O. Estimated cost $1,000,000.

**Storage Building**—Morris Paper Mills, Novis, Ill., have awarded the contract for a storage building to Hansen & Peterson, 600 Des Plaines St., Joliet, Ill. Estimated cost $110,000.

**Warehouse**—Great Lakes Paper Co., Ltd., 20 King St., E., Toronto, Ont., Can. has awarded the contract for a warehouse at its pulp mill at Fort William, Ont., to Barnett-McQueen Construction Co., 460 Christina St., Fort William. Estimated cost $75,000.

**Warehouse**—Joseph H. Seagram & Sons, Lawrenceburg, Ind., has awarded the contract for the construction of a warehouse to J. & E. Warm Co., 2335 Florence St., Cincinnati, O. Estimated cost $350,000.

**Sodium Sulphite Mines**—International Nickel Co., Ltd., Copper Cliff, Ont., Can., has purchased the plant of the Horse Shoe Lake Mining Co., Ltd., at Ormiston, Ont., and plans extensive additions. Work will be done by separate contracts. Estimated cost $200,000.

### Where Plants Are Being Built in Process Industries

| | Current Projects | | Cumulative 1937 | |
|---|---|---|---|---|
| | Proposed Work | Contracts | Proposed Work | Contracts |
| New England | $500,000 | $580,000 | $690,000 | $80,000 |
| Middle Atlantic | 135,000 | 745,000 | 7,837,000 | 4,967,000 |
| South | .......... | 250,000 | 810,000 | 16,961,000 |
| Middle West | 440,000 | 3,853,000 | 3,123,000 | 4,889,000 |
| West of Mississippi | 590,000 | 830,000 | 6,820,000 | 3,740,000 |
| Far West | .......... | 1,390,000 | 2,800,000 | 4,383,000 |
| Canada | .......... | 331,000 | 330,000 | 371,000 |
| Total | $1,665,000 | $7,979,000 | $22,410,000 | $35,391,000 |

## • PRODUCTION OF COMPRESSED AND LIQUEFIED GASES •

ESTABLISHMENTS engaged in the production of compressed and liquefied gases in the United States reported substantial increases in employment and production in 1935 as compared with 1933, according to preliminary figures compiled from the returns of the Biennial Census of Manufactures.

These establishments employed 3,788 wage earners in 1935, an increase of 37.1 per cent over 2,763 reported for 1933, and their wages $4,408,205, exceeded the 1933 figure, $3,154,300, by 39.8 per cent. The total value (at f.o.b. factory prices) of compressed and liquefied gases produced in 1935 amounted to $67,097,338, an increase of 39.2 per cent as compared with $48,185,381 reported for 1933. The production of oxygen, which ranked first in importance, amounted to 2,675,396 M cu.ft., valued at $18,115,968, representing increases of 46.8 per cent in quantity and 39.4 per cent in value as compared with 1933. For acetylene, second in importance, the report shows a production of 1,133,824 M cu.ft., valued at $14,747,854, the rates of increase over 1933 being 50.4 per cent in quantity and 33.6 per cent in value. The production of solid carbon dioxide ("dry ice") increased 179.6 per cent in quantity and 64.8 per cent in value from 59,057,600 lb., valued at $1,969,526, in 1933 to 165,123,912 lb., valued at $3,245,692, in 1935.

This industry as constituted for Census purposes, embraces establishments engaged primarily in the production of gases sold usually in compressed and liquefied forms but in some cases (as carbon dioxide for the manufacture of "dry ice" and hydrogen for the manufacture of ammonia and other commodities) delivered through pipes.

Statistics for 1935, with comparative figures for earlier years, are presented in the following tables. All figures for 1935 are preliminary and subject to revision.

▼ ▼ ▼

| | 1935 | 1933 | 1929 |
|---|---|---|---|
| 1. Compressed and liquefied gases industry, all products, total value | $42,018,951 | $32,007,108 | $52,189,779 |
| 2. Compressed and liquefied gases | $40,756,604 | $31,725,924 | $51,622,803 |
| 3. Other products (not normally belonging to the industry) | $1,262,347 | $281,184 | $566,976 |
| 4. Compressed and liquefied gases made as secondary products in other industries, value | $26,340,734 | [1] $16,459,457 | $19,670,116 |
| Compressed and liquefied gases, aggregate value (sum of 2 and 4) | $67,097,338 | [1] $48,185,381 | $71,292,919 |
| Ammonia, anhydrous:[2] | | | |
| Number of establishments | 10 | [1] 8 | 16 |
| Pounds [3] | 138,245,032 | [1] 150,184,618 | 173,349,355 |
| Value [3] | $5,674,063 | [1] $5,930,049 | $10,673,234 |
| Chlorine: | | | |
| Number of establishments | 21 | [1] 20 | 20 |
| Total production, tons [4] | 319,303 | [1] 217,089 | 199,472 |
| Made and consumed in same establishments, tons [4] | 112,144 | [1] 92,526 | 54,545 |
| Made for sale: | | | |
| Number of establishments | 18 | 16 | 17 |
| Tons | 207,159 | 124,563 | 144,927 |
| Value | $7,944,266 | $4,486,325 | $7,113,091 |
| Hydrogen: | | | |
| Number of establishments | 40 | 36 | 44 |
| M cubic feet [5] | 743,860 | 589,290 | 207,843 |
| Value | $1,556,658 | $914,532 | $1,423,456 |
| Hydrocarbon gases: | | | |
| Acetylene: | | | |
| Number of establishments | 116 | 108 | 104 |
| M cubic feet | 1,133,824 | 754,089 | 969,534 |
| Value | $14,747,854 | $11,038,959 | $16,553,763 |
| Liquefied petroleum gases: | | | |
| Number of establishments | 33 | 19 | |
| M gallons | 381,738 | 178,630 | (6) |
| Value | $7,989,298 | $2,524,098 | |
| Other hydrocarbon gases, value | $501,338 | $1,216,859 | $2,447,196 |
| Nitrous oxide: | | | |
| Number of establishments | 12 | 10 | 9 |
| M gallons | 95,861 | 82,220 | 109,812 |
| Value | $945,802 | $810,529 | $1,196,392 |
| Oxygen: | | | |
| Number of establishments | 162 | 160 | 178 |
| M cubic feet, total | 2,675,396 | 1,821,880 | 3,140,095 |
| Liquefaction process | 2,584,251 | 1,756,961 | 2,816,641 |
| Electrolytic process | 91,145 | 64,919 | 323,454 |
| Value | $18,115,968 | $12,997,005 | $23,409,606 |
| Sulphur dioxide: | | | |
| Number of establishments | 5 | 5 | 4 |
| Pounds | 24,628,183 | 19,559,779 | 17,600,936 |
| Value | $1,170,401 | $967,657 | $973,596 |
| Carbon dioxide (not including "dry ice"): | | | |
| Number of establishments | 58 | 50 | 54 |
| Pounds [7] | 87,407,476 | 117,382,256 | 136,930,311 |
| Value | $4,528,449 | $4,466,461 | $6,931,735 |
| Solid carbon dioxide ("dry ice"): | | | |
| Number of establishments | 35 | 26 | (6) |
| Pounds | 165,123,912 | 59,057,600 | |
| Value | $3,245,692 | $1,969,526 | $570,850 |
| Other gases, value | $677,549 | $863,381 | |

[1] Revised.
[2] Not including production in Coke and Manufactured Gas industries.
[3] Includes production from ammonia liquor. The amount of such production in 1935 was 2,990,685 pounds, valued at $388,699. No corresponding data are available for earlier years.
[4] Not including chlorine made and consumed in Wood Pulp industry.
[5] Includes data for hydrogen sold through pipe lines to consumers. The amount thus sold in 1935 (estimated) was 537,000 M cubic feet. No corresponding estimates have been made for earlier years.
[6] No data.
[7] Includes data for carbon dioxide piped to plants making "dry ice." The quantities thus piped in 1935 and 1933 (estimated) were 25,285,000 pounds and 64,500,000 pounds, respectively. No corresponding estimate has been made for 1929.

### Wood Distillation and Charcoal Manufacture

| | 1935 |
|---|---|
| 1. Wood distillation and charcoal manufacture industry, all products, total value | $15,970,917 |
| 2. Wood-distillation products and charcoal | 15,750,936 |
| 3. Other products (not normally belonging to the industry) | 219,981 |
| 4. Wood-distillation products and charcoal made as secondary products in other industries, value | 6,995 |
| Wood-distillation products and charcoal, total value (sum of 2 and 4) | $15,757,931 |
| Methanol (wood alcohol): | |
| Crude, total production, gallons | [1] 4,528,480 |
| Made and consumed in same establishments, gallons | [1] 2,579,874 |
| Made for sale: | |
| Gallons | [1] 1,948,606 |
| Value | $315,753 |
| Refined: | |
| Gallons | [2] 3,648,180 |
| Value | $1,148,548 |
| Acetate of lime (gray): | |
| Tons | [3] 25,846 |
| Value | $825,522 |
| Miscellaneous chemicals (acetic acid,[4] ethyl acetate, etc.), value | $1,889,796 |
| Tar, total production, gallons | 9,983,934 |
| Made and consumed in same establishments, gallons | 6,613,153 |
| Made for sale: | |
| Gallons | 3,370,781 |
| Value | $544,560 |
| Tar oils: | |
| Gallons | 1,087,492 |
| Value | $194,261 |
| Turpentine, wood:[5] | |
| Gallons | 4,611,641 |
| Value | $1,853,925 |
| Pine oil: | |
| Gallons | 3,443,315 |
| Value | $1,525,938 |
| Rosin, wood:[5] | |
| Barrels (500 pounds) | 529,001 |
| Value | $4,171,862 |
| Charcoal, total production, bushels | [6] 34,157,752 |
| Made and consumed in same establishments, bushels | 7,269,136 |
| Made for sale: | |
| Total bushels | [6] 26,888,616 |
| Total value | [6] $3,063,200 |
| Hardwood and softwood distillation: | |
| Bushels | [6] 26,216,308 |
| Value | $2,952,142 |
| Kiln and pit: | |
| Bushels | 672,308 |
| Value | $111,058 |
| Other wood products, value | $224,566 |

[1] Strength, 82%. (Not reported for earlier years.)
[2] Strength, 100%. (Not reported for earlier years.)
[3] Strength, 80%. (Not reported for earlier years.)
[4] For production of acetic acid in the Chemical industry, see preliminary report entitled "Production of Acids."
[5] For production of gum turpentine and gum rosin, see report entitled "Gum Turpentine and Rosin."
[6] Includes data for charcoal screenings; production for sale amounted to 182,000 bushels, valued at $10,074.